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Warning from Executives Would Retain Public Confidence

VOICING what may easily be regarded as a warning of the dangers of current market speculation, Secretary Mellon in his annual Treasury Department report leaves the implication that if the Federal Reserve banks could find some effective and safe method of checking the orgy, they undoubtedly would use it. Reading between the lines, one infers that the Reserve banks are powerless to control the situation.

The utilities are vitally concerned with this matter. Long years of educational effort were required to implant in the public mind the idea of the essential stability of their stocks. Their equities were steadily strengthened, economies were introduced and operating costs were lowered. At last the public accepted the idea. Then came the runaway market. Fifteen representative common stocks of the power and light group have on the average advanced more than 50 points since the first of last January. Twenty representative leaders are now selling at sixteen times their earnings.

No one would deny that much of this gain is justified, but the situation surely involves the germ of a danger of the loss of hard-won confidence. It is the public that is responsible for most of the buying today. Individuals are entering the market at high levels. If they lose, they will be strongly disposed to blame the utilities—to suspect manipulation of some sort. If utility executives regard the situation as dangerous, a precautionary warning to the public, even if it falls on deaf ears, would probably conserve confidence in the industry. It is significant that the industry leaders have this market lever which could be used even if the Federal Reserve system finds itself powerless.

* * * *

A Memorial to Individual Prowess and Government Inefficiency

A MEMORIAL tablet to the late Charles R. Huntley was to be unveiled in Buffalo on Saturday of this week in connection with the starting of what is purported to be the world's largest single-cylinder steam turbo-generator—100,000 horsepower. It is not our purpose at this time to dwell on those characteristics of courage, foresight and faith possessed in marked degree by that pioneer of electrical development on the Niagara frontier. The Huntley station at Buffalo is a monument of which the Buffalo General Electric Company and the friends and kin of Charles Russell Huntley may well be proud, and yet in another sense it is a monument that should cause the national government to blush for shame. With water enough and to spare for one of the grandest sights in the world, millions of potential horsepower are wasted daily at Niagara Falls, while already millions of tons of coal have been burned at Buffalo to generate electricity which Niagara could easily supply without affecting its scenic grandeur.

More than a billion kilowatt-hours of electricity is imported yearly from Canada at a cost of millions of dollars, to the enrichment of that neighboring country and to our own loss. Of the 56,000 cubic feet of water per second allowed to be diverted for power purposes under treaty, Canada gets 36,000 and this country only 20,000 cubic feet per second. All the water is being used to the last drop in the most efficient hydro-electric stations in the world, but twice as much water could be used and Niagara's beauty actually increased to the great advantage of the industries and people of that district. Electricity they must and will have even if coal must be burned to generate it, and it is for the government to decide whether the present treaty shall be revised and power now wasted conserved or whether a spectacle worth more than $40,000,000 a year, or $200 a look per tourist, shall be maintained indefinitely.

The Huntley station will have to be doubled in capacity before long to supply the electric needs of the Niagara district. It will require years to harness any extra water released by a revised treaty. The market will not wait, however; but the sooner the treaty is revised the greater the saving in money will be and the richer New York State, the national government and American industry.

* * * *

Effect of Rates That Are "a Little Too High"

COLLECTIVELY all classes of public service corporations in this country have been intrusted with about fifty billion dollars of the savings of the American people. This is about one-seventh of the estimated wealth of the United States. These companies require about two and a half billion dollars of additional money every year. The financial support and the economic health of this great popular investment is therefore a very important concern to the men and women who have placed so much of their reserve cash in these enterprises for safekeeping and that it may earn an income.

Speaking to this theme the other day before the Advertising Club of New York, Martin Insull discussed the severe competition which the power industry has to meet in the money market in order to secure the new capital annually required. He made the point that the public is actually better served by a rate that is a little too high than by one that is too low, because it makes for a better financial position and an industry in which the investor has greater confidence. This is sound doctrine from the standpoint of the conservative financier. There is an-

other factor, however, that is no less important, in measuring the responsibility of the utility to the public.

The power industry has made electric service available to almost the entire country. But, excluding manufacturers and business men who are employing electricity extensively, electric service today is used by most people for little more than light. In the broad terms of public service, its enjoyment by the very people who control the power utilities and have put their money into them is so far very incomplete. Which prompts a question as to how far the prosperity of a power company may also depend upon its courage and wise policy in establishing inducement rates and increasing sales in order to popularize its product.

It is true that the administration of a utility must be economically sound if it is to compete successfully in the money market. But it is no less true that public confidence in the stability of the power business increases immeasurably with the intensive growth of the popular use of electric service. For a more complete equipment of the American home brings a larger income from the individual customer and consequently a larger return from the utility's investment. This in turn strengthens the position of the power company in the money market.

The public purchases electric service at a low price today as gaged by other costs of living. Rates for electricity are not too high. This is one basis for the public confidence in this great industry. But that confidence must be protected by adequate rates, by a progressive policy that steadily promotes a larger use of electricity and by the promotional type of rate, making possible a wider enjoyment of the service.

* * * *

Steam to the Fore on the Pacific Coast

NOT a single hydro-electric plant is scheduled for completion on the Pacific Coast during 1929, but the steam construction programs for a number of the larger utilities show that steam generation is assuming a more and more dominant position every day. The Pacific Northwest, stronghold of hydro, has at last been invaded by steam, and the announcement comes that the Puget Sound Power & Light Company will build a thirty-million-dollar fuel-fired plant in Seattle with six units of 35,000 kw. each, work on the first of which is to be started immediately. One of the Portland central-station companies is installing a 20,000-kw. steam unit, and the other is seriously considering further steam capacity as against hydro.

Greater economy of steam led the Southern California Edison Company to abandon temporarily its Big Creek hydro-electric project and to embark upon an eight-year steam program which will complete an 800,000-kw. plant. The first 90,000-kw. unit of this plant was placed in operation during the past summer and the second is scheduled for completion during 1929. The San Diego Gas & Electric Company and the Los Angeles Gas & Electric Corporation both have recently completed 30,000 kw. to 35,000-kw. additions to existing plants. In the San Francisco Bay region the Pacific Gas & Electric Company has just completed a 37,500-kw. addition to an existing plant, and the Great Western Power Company has under construction the first unit of a 375,000-kw. steam plant.

Aside from the municipal systems at Seattle and Tacoma, the Pacific Gas & Electric Company is the only utility on the Pacific Coast that has a hydro-electric project of any consequence under construction. This is its Salt Springs plant, but the first unit will not be brought in until 1930 or later. The only new development in prospect is the Lewis River project of the Northwestern Electric Company, just announced. While hydro-electricity will play the major part in power generation in this territory for at least several years to come, yet it is clear that steam is destined to play an important rôle in the future.

* * * *

An Obligation of Authority

CHRISTMAS has become a festival of light. Electricity is the recognized medium for its production. The candle-lighted tree long since gave way to safe, many-colored miniature lamps for the evergreens. Popular fancy has grasped the suggestion of lighting the trees out of doors. Community efforts become increasingly evident. Merchants quickly accept the value of increased illumination of holiday character to attract shoppers at the Christmas season. The electric light and power companies have incurred a new community obligation.

As public servants possessing the authority of familiarity with electrical applications and developments, it is the duty of the utilities to offer by example and consultation the best of contemporary practices in Yuletide illuminating effects. Lighting is no more a static art than it is a perfect one. Each year witnesses development in the accumulated knowledge upon this subject, and each year offers an opportunity to the utilities to better their service to the community through window commercial sales office and exterior illumination. Unusual applications often lead to improvements in the more common ones, and the progressive efforts in Christmas illuminating effects deserve, for their pioneering character, higher praise.

The intangible spirit of Christmas is reflected in ways amazingly removed from the basic element of observation of the accepted anniversary of the birth of a great religious leader, but it is fostered by the expression of good wishes, the exchange of gifts and greetings, and by the glow of symbolic light shining through the heavy night of long winter.

* * * *

Economic Feasibility of Boulder Canyon Dam

THE Colorado River Board is confident of the engineering practicability of Boulder Canyon Dam but is a trifle diplomatic when it deals with the economic feasibility of the project. It pleads for time, and Congress probably will give the board more time and more money.

Many elements enter into the Boulder Dam situation. A primary one is the interest of California in a water supply, and debate has been waged with Arizona and other states on how much water California needs or can get. In addition each state desires to get revenue out of the project either through taxation or through the sale of power or water. Money interest in some form or other sways state decisions.

It might be well to consider the dam from the point of view of unit cost of power. On the basis of costs and outputs reported by the Colorado River Board each

kilowatt-hour of firm power will cost, in fixed charges alone, 0.573 mill to produce. If the power plant only is charged to power cost, this fixed charge becomes 0.152 mill per kilowatt-hour. These costs do not consider operating charges nor the costs involved in transmitting this power 300 miles to load centers on the coast. Transmission costs would add from 0.03 mill to 1 mill to the charges, depending upon the number of circuits used. The maximum power cost at these load centers must be about 3 mills if any one is to buy large amounts of Colorado River power in competition with more reliable local steam-generated power. This means that only about $50,000,000 of the $176,000,000 total cost of the development could be charged to power, and even this sum must be reduced if a large proportion of the power is used at the site for pumping water to California. If states tax the power produced, there is a still further reduction in the sum that can be charged to power production.

Power revenues will not build Boulder Dam. If this development is needed, then it must be paid for without the exaggerated and erroneous conception that it will be a bonanza revenue producer through the sale of electrical energy.

* * * *

Who Can Warehouse Utilities' Supplies Most Economically?

IN THIS age of specialization it is but common sense for business men to develop their own proficiency in their own specialties. But it is no less sensible to avoid assuming responsibility for work that some other specialist can do more economically. There is a principle involved here that should be given more attention by the power companies in their relationship with the wholesalers of electrical supplies. Two viewpoints were expressed at the recent wholesalers' convention that bear interestingly upon it.

P. S. Arkwright, president of the National Electric Light Association, described the difficulties involved in the handling of gas appliances by his company. Because there is no wholesaler to serve him in this field, he must buy in quantity from the manufacturer and assume the full detail of transportation, warehousing and delivery. He must pay the costs of interest on investment, breakage, obsolescence, depreciation and slow turnover. Delayed deliveries and the vicissitudes of stock keeping are a constant source of annoyance. All this is in direct contrast with the conditions under which electrical appliances are sold, for there the local jobber carries the stock, performs the warehousing function and delivers on order as the goods are needed. And Mr. Arkwright bewailed the lack of a gas jobber.

G. E. Cullinan, chairman of the National Electrical Wholesalers' Association, speaking before the same meeting, stressed the fact that the jobber has too long beguiled himself with the idea that his most important function is the creation of markets. Yet his specialty, as Mr. Cullinan pointed out, should be primarily the accumulation, warehousing and delivering of electrical equipment and supplies, since here lies his opportunity for service in the economic balance of the industry. For, just as the power companies are specialists in the generation and distribution of electrical energy, so are the wholesalers specialists in the selection and distribution of manufactured electrical products. It would, therefore, seem to be a reflection upon both the power companies and the wholesalers that the utilities are today performing so large a warehousing operation for themselves.

The question continues to come up, What is the comparative cost of warehousing the supplies that power companies purchase? Can the wholesaler do it more cheaply or the utility? Nobody knows with accuracy. But in the public interest both the wholesalers and the power companies should find out.

* * * *

The Challenge of Adequate House Wiring

A LEADING utility engineer in the East is building a suburban home. Being an enthusiast on electric service, he has spent many hours with his architect in selecting the right places for outlets from one end of the house to the other, and even to the uttermost corner of the garage, in order that convenience may be enjoyed to the full and some of the possibilities of decorative home lighting tested on a befitting scale. A well-known wiring contractor is making the installation, but over and over again the owner has been obliged to insist against vigorous protests that the specifications must be carried out as written and that the number of outlets, size of wire and arrangement of switching facilities indicated is a true measure of his requirements as a home builder. Apparently the contractor is imbued with the idea that he is professionally bound to save his client money by cutting down the size and scope of the job. If the engineer in question were easily discouraged, the installation would finally shrink to an amazingly reduced percentage of the original requirements.

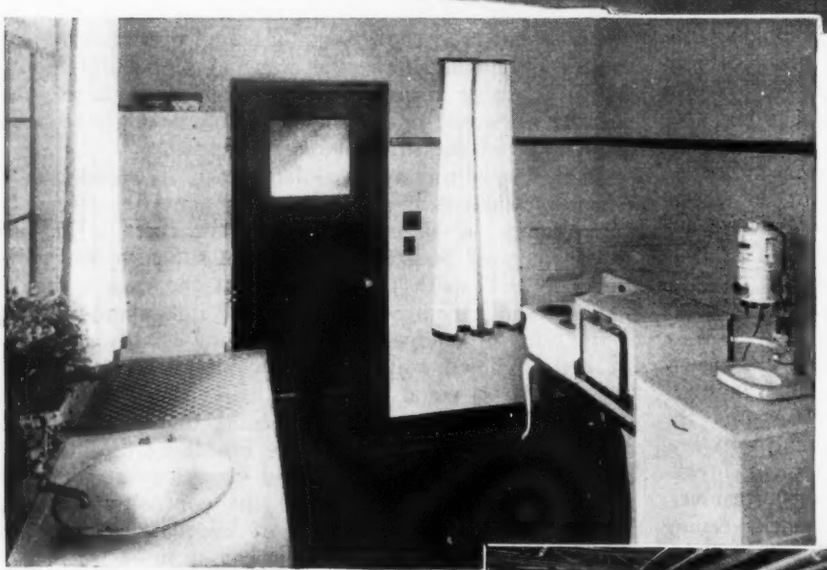
If this were merely an isolated case, it would hardly deserve comment in these columns; but unfortunately the practice of skimping jobs to cut costs is an old offense against progress. It will not suffice to wave the incident aside with the remark that the owner should have picked a contractor with more imagination and a better idea of co-operation. The long-established habit of cutting down house-wiring layouts through fear of the wrath to come when the bills are presented or because of anxiety over net profits or competition is the *bête noire* of the contracting branch of the industry in many places today. It is bad enough to run against this inhibition in cases where the contractor is in a position to act as a salesman of adequate wiring, but in instances where the builder of a home or other structure knows exactly what he wants and is prepared to pay the price, it is nothing short of lamentable for the wiring concern to furnish anything less than 100 per cent co-operation.

Think of the effect on the progress of the industry of an attitude so diametrically opposite that of the plumber, the house furnisher, the music dealer and the motor-car distributor! No one will advocate the waste of money on excessive wiring installations, but even "red seal" standards do not express the ultimate in home service and more outlets rather than fewer spell prosperity to every branch of the industry. The contractor cannot do all the selling, even if he wanted to, and it is time for many well-intentioned people in the industry to realize that only through more constructive co-operation in sales activities and front-line contacts with the public will the American people visualize, accept and cheerfully pay for anything like complete electric wiring and service in the home.

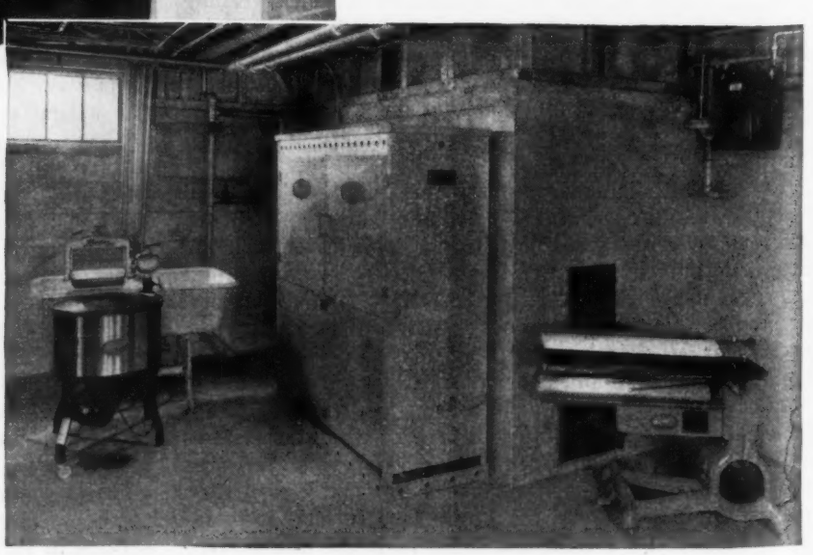
A Cobbler Shoes His Children

BELIEVING that men in the electrical industry should follow and not merely preach their slogan "Do It Electrically," Walter Bates, president of the Walter Bates Steel Corporation, utilized electricity extensively in building his new home and has applied this power to many purposes affording convenience, comfort and economy. The frame of his residence is all steel and was largely electrically welded throughout. Numerous electrical conveniences are installed in the house, which follows "red seal" specifications.

The electric equipment includes a water heater, clothes washer, ironer and drier, range, refrigerator, dishwasher, kitchenaid, clocks and radio. In the nine rooms there are 209 outlets. Even the garage doors are operated electrically.



The all-electric kitchen is but one of the attractive features of this ultra-modern home.



An electric washer, drier and ironer constitute part of the electrical laundry equipment.

Double-Winding Generator

Solves Breaker Problem

Three plans considered for handling output of 160,000-kw. units to minimize number and short-circuit duty of switches and reactors and avoid excessive bus voltage depressions during shorts

By D. D. CHASE* and H. C. FORBES†

IN CONSIDERING the installation of additional generating units at the East River station of the New York Edison Company it was of paramount importance in the interest of economy to make provision for units of very large capacity. For the next unit to be installed a generator has been selected which will be mounted on a single shaft and will have a rating of 160,000 kw. It is being designed and built by the General Electric Company at Schenectady, N. Y.

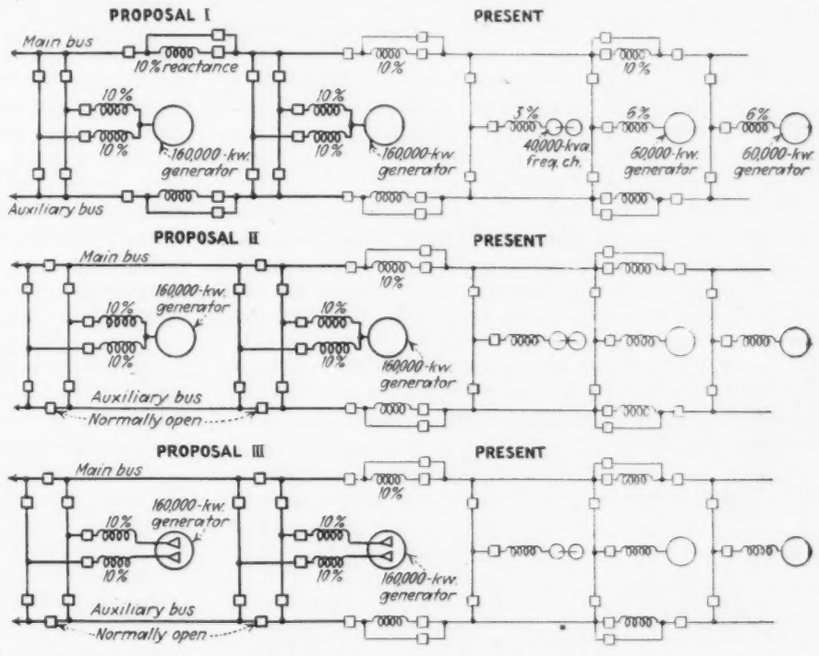
The choice of a generator of such an immense capacity involved some new and interesting features in generator and power plant design which have been worked out by the engineers of the manufacturer and user in a somewhat novel manner. It is the purpose of this article to discuss the problems encountered and to present in some detail the electrical design characteristics of the double-winding generator which were adopted as meeting the electrical requirements in the most satisfactory manner.

The electrical connections of the generators now installed in the station are shown by the light lines at the right. In planning the extension of the station three alternatives were considered:

Proposition I—The first thought naturally was to continue connecting the projected large units to the bus as formerly, giving the connections indicated by the heavy lines. With this arrangement it would have been necessary to use a complete double set of generator switches, selector switches and also two generator reactors for each unit. The double set of switches were required since it was not possible to obtain a single switch capable of carrying the entire output of a 160,000-kw. generator, which is about 8,000 amp. It also appeared that a reactor rated at about 5 per cent (based on the rating of the generator) would be required, but it was not feasible to use a single reactor which would carry 8,000 amp. The alternative was to use two 10 per cent reactors connected as shown in Fig. 1. This assures a satisfactory division of load between the two sets of generator and selector switches.

Proposition II—The second plan considered is shown in Fig. 2. It will be noted that in the proposed extension the generator reactors now serve also as bus reactors. The simplification of Proposition II as compared to Proposition I is obvious.

Proposition III—Attention was next turned to the suggestion of the General Electric engineers that the generators be built with two electrically distinct windings. The proposed connections for this plan are illustrated by Fig. 3. Here it is to be noted that the only coupling provided between the adjacent bus sections is that afforded by the mutual reactance of the two windings.



Figs. 1, 2 and 3—Three plans considered for handling the output of 160,000-kw. generators

The equipment required for each of the three proposals is indicated in Table I. By using Proposition II or III it is observed that a very large saving in equipment is effected compared with Proposition I. The corresponding saving in building space is of very great value. On this basis Propositions II and III are of equal merit.

Let us next consider the conditions when a short circuit occurs on one section of the bus. Although Figs. 1, 2 and 3 show only two 160,000-kw. generators, of course

*General Electric Company. †New York Edison Company.

any number might be connected in a similar manner and the short-circuit studies were made for an assumed condition of seven machines. If the short circuit is taken at the middle of such a group of generators it will be found that the conditions will be substantially the same as for a greater number of machines so connected since the generators which are electrically remote from the fault do not contribute a material amount of short-circuit current.

The comparative short-circuit kilovolt-amperes and the approximate voltages on the first and second bus sections from the short circuit are shown in Table II, on page 1185.

The figures clearly indicate the advantage of the double-winding generator when utilized as in Proposition III as a means of minimizing and localizing the disturbance caused by short circuits in the generating station. The improvement of Proposition II in this respect as compared to Proposition I is also worthy of note.

Two Windings in Separate Slots

Three types of double windings could be considered for this purpose:

Type A consists of two complete and independent windings in the same stator, each having two coil sides in every slot. This is generally used for multi-speed induction motors with odd speed ratios, but it is very expensive, due to the double amount of insulation required. Also, in this case, the two windings have slightly different reactances, and therefore cannot be used very satisfactorily as two equally loaded circuits feeding power to symmetrical terminal apparatus.

Type B winding, which has often been considered in the past, is simply a standard two-circuit winding with alternate poles in series in each circuit. With a two-pole machine, for example, instead of paralleling the two poles inside the machine, the terminals from each pole may be brought outside and connected to separate loads. In this case, however, any inequality in the loads fed from the two circuits will produce severe magnetic unbalance, resulting in mechanical vibration and impossible operating conditions.

Type C is one in which alternate slots around the machine are connected to separate circuits as illustrated in

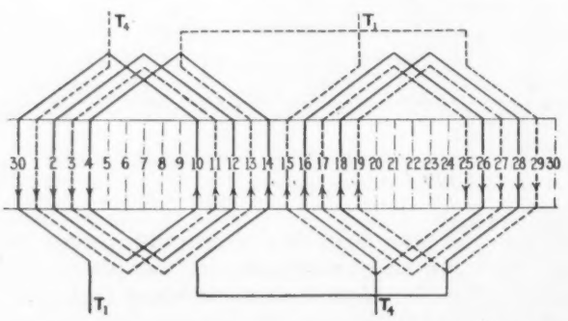


Fig. 4—How two windings in separate slots are connected to balance voltages and magnetic forces

Fig. 4. Since the voltages in the two circuits under one pole made in this way are out of phase by an angle corresponding to one slot pitch, it is necessary to alternate the circuits which are leading under adjacent poles. In this way a voltage balance between circuits may be obtained on any machine on which two balanced circuits can normally be obtained. With this scheme each circuit is distributed around the complete periphery, producing perfectly balanced magnetic forces. Furthermore, the winding requires no additional insulation or space above that of a standard machine, except for the additional number and special arrangement of the end connections and leads.

The last type of winding is, therefore, entirely satisfactory for the purposes outlined. It is being used on the 160,000-kw., two-pole turbo-generator illustrated at the bottom of page 1185, which is now on order with the General Electric Company.

Transient Reactance

The ordinary synchronous machine is frequently treated as a transformer with the frequency of one winding reduced to zero in normal operation by synchronous

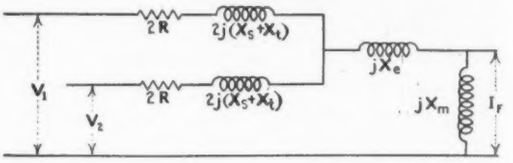


Fig. 5—Circuit equivalent of double-winding generator

rotation. For all transient phenomena the machine is a transformer, to all intents and purposes, with primary and secondary windings each having its own resistance and leakage reactance. When the armature winding is separated into two independent parts the machine becomes a three-winding transformer. If a squirrel-cage winding or solid rotor is present it is convenient to lump the constants with those of the field rather than use the general equation for a four-winding transformer.

In calculating the characteristics of a three-winding transformer, we must take into account the total flux generated by a current in any winding, and the portion of that flux that is common to each pair of windings. In the case of a generator, the total leakage reactance of the windings in parallel consists of three parts, the slot leakage, the end leakage and tooth tip or combined belt and zigzag leakage. These values will be represented by X_s, X_e and X_t, respectively.

The slot leakage flux due to either winding does not link the other nor the field, so that this element is purely self-inductive, at least for certain winding pitches. The slot reactance of either winding alone is just twice that of two windings in parallel, since the current is concentrated in half the total number of slots, the magnetomotive force producing slot leakage is the same, and the reluctance of the path is only one-half as great as when the current is equally divided among all the slots.

The end leakage flux due to one winding alone is practically the same as for both windings, since it is not appreciably altered by concentrating the current in half the coils, as long as these coils are equally spaced around the periphery. And, for the same reason, the end leakage flux links both the windings equally.

The zigzag leakage flux due to one winding alone is four times as great as that due to the same current flowing in both windings in parallel. By concentrating in only half the number of slots the number of times the flux is forced across the air gap is cut in two and the area of each path across the gap is nearly doubled. Practically all the increase in this flux links only the one winding and, hence, is self-inductive.

The belt leakage flux due to the line-frequency harmonic fluxes set up by the concentration of the winding in the phase belt is also increased when one winding

Table I—Comparison of Switch and Reactor Requirements with Three Propositions

(See Figs. 1, 2 and 3)

Proposition	Requirements per Phase per Generator Switches	Reactors
I	12	4
II	8	2
III	8	2

alone is used. However, both the zigzag and belt leakages are partially wiped out by induced high-frequency rotor currents in the rotor. It has been found that this results in a leakage approximately twice the zigzag leakage of the two windings in parallel.

Since the operation of a double-winding generator depends upon the leakage reactances of the two windings and on the mutual reactance between the windings it is necessary to calculate these values quite accurately if satisfactory predictions of performance are to be made. The formulas now generally used for the reactance of synchronous machines are therefore not adequate for the design of a double-winding generator. More accurate formulas and data on reactance which are satisfactory for the purpose are presented in an article by P. L. Alger entitled "The Calculation of the Armature Reactance of Synchronous Machines," which was presented at the midwinter convention of the American Institute of Electrical Engineers on Feb. 15.

On the basis of the simple theory that has been presented, the one-line diagram of a double-winding generator will appear as shown in Fig. 5. In this figure X_s represents the slot reactance of a normal one-circuit machine of the same total rating. X_t represents the tooth-tip leakage, X_e the end leakage, R the primary resistance and X_m the magnetizing reactance, all on the same basis. Fig. 2 shows at once that it is possible to transfer power from one bus section to another through the generator. This possibility has led to the new system of bus layout for a large power station shown in Fig. 3.

Flexibility of Loading

The progressive subdivision of generating station buses into sections separated by higher and higher reactance has necessarily been accompanied by some loss in flexibility of load transfer from one machine to another by transmitting the power through the busbars. In the early stations where all the feeders and generators were connected to a solid bus complete flexibility in this respect existed. The adoption of such a bus layout as that in Fig. 1 entailed some sacrifice, and the use of the double-winding generators as in Fig. 3 still further reduced the possibilities of load transfer through the buses. It has thus gradually become more essential to allocate the feeders in such a manner that the loads to be carried on each of the bus sections are closely proportional to the corresponding generator capacities.

With double-winding generators, however, a certain amount of flexibility in loading is permitted, because either winding may be loaded to a maximum of 90,000 kw., provided the total load in both windings is not greater than 160,000 kw. In other words, any one bus section could be supplied with a maximum of 180,000 kw. directly from the generators. This bus section capacity will be supplemented at East River station by a 30,000-kva. generating station tie, making 210,000 kva.

Table II—Comparative Short-Circuit Values Obtained

(See Figs. 1, 2 and 3)

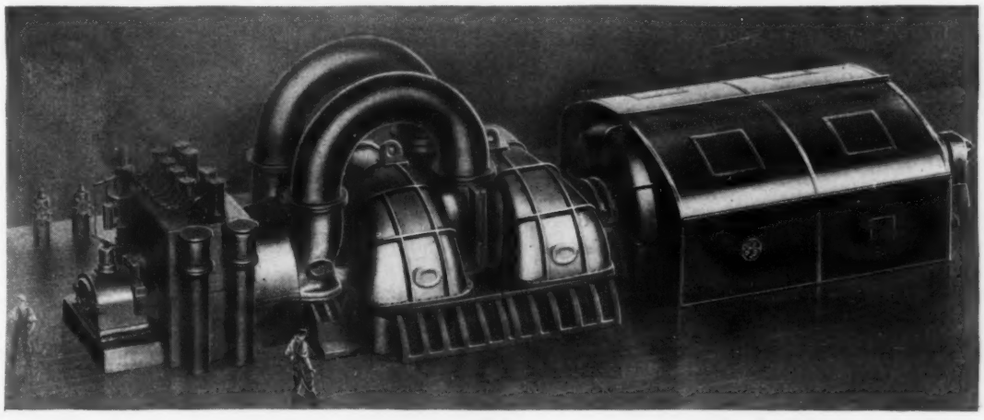
Proposition	Instantaneous Short-Circuit, Kilovolt-Amperes	Per Cent of Normal Voltage on Adjacent Bus Sections: First Section from Short	Second Section from Short
I	2,680,000	53	75
II	1,790,000	71	91
III	1,450,000	86	98

available per bus section. In emergencies the reserve in substation feeder capacity can also be utilized to effect a transfer in load, since the loading of the individual feeders is under control at the substation.

Tests and theoretical studies of the double-winding generator used in connection with the station layout shown in Fig. 3 prove that in addition to generating power in each winding and transferring power through the unit as a transformer it is possible by varying the field of the unit to vary the power factor, and thus to operate with a limited variation of voltage on the different bus sections, depending upon the loads and wattless power carried by the units.

Grounding of Bus Sections

The fact that the several bus sections, when connected by means of double-winding generators, are coupled only by a transformer action makes it necessary to provide a grounding arrangement for each bus section. If the generators are star connected this can be done by grounding the machine neutrals either solidly or through impedance devices, as the case may be. Generally speaking, if the bus sections have ties to a source of ground current elsewhere on the system, no other provisions for grounding need be made. When impedance devices are used in the ground connection it may be objectionable, on account of the increase in ground current, to have



160,000-kw. unit for East River station

several of the generator neutrals grounded simultaneously, although it may still be desirable to have these neutrals so arranged that any one of them can be grounded in case the ties which are depended upon for ground current are out of service.

It was considered preferable in the case of the generator now on order for the East River station to have the windings delta connected, and for the present the system ties will be relied upon to furnish ground current, but arrangements may be made in the future so that the neutral of any bus section can be grounded by means of a suitable connection to a zigzag grounding transformer in case the ties to that bus section are out of service.

Operating Advantages

The double-winding arrangement incidentally offers the interesting possibility that when a ground occurs on one of the two windings of the machine that winding may be disconnected from the bus without taking the other winding out of service. The only residual current flowing to ground in the faulty winding would be the winding charging current, probably in the neighborhood of 1 amp. It should therefore be entirely feasible to keep the undamaged winding in service at least for such a period of time as would ordinarily be required to readjust the system loading so that the machine could be conveniently taken out of service.

In case of a simultaneous ground in both windings or a short circuit in either winding the generator would be taken off the bus and the field opened at the same time, all of these operations, of course, being performed by suitable relaying. It is to be expected that the majority of faults will be grounds and will involve only one winding, so this feature may be of considerable value.

As the 25-cycle system of the New York Edison Company supplies its direct current substations by means of radial feeders (each feeder supplying its own particular converter or converters and not being bused together with any other feeder at the substation) it is therefore dependent upon the generating station ties for the maintenance of synchronism. A high degree of stability, of course, is very essential, particularly since damage to the rotary converters is likely to occur if part of the system gets out of synchronism.

Inherent Sectionalizing Reactance

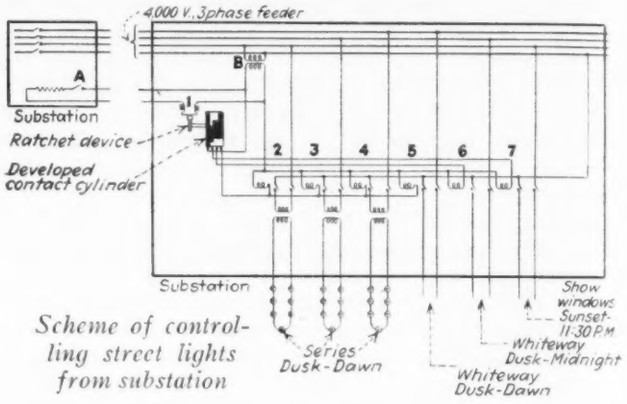
A high value of reactance in the buses between the generators is clearly a desirable way of reducing the magnitude of short-circuit disturbances, since it does not proportionately increase the reactance of the system to normal load currents. It may be objectionable, however, on the ground that the stability of the machines in that station is reduced. This is very undesirable as it may result in tripping the system ties so that part of the system becomes isolated and falls out of synchronism.

The double-winding generators afforded a solution whereby the desired high reactance between bus sections could be obtained with no sacrifice in stability since the two windings are on the same stator and must necessarily be in synchronism at all times. In fact, preliminary tests have indicated that an exceptionally good performance from the standpoint of stability is to be expected.

The engineers of the New York Edison Company now have in mind the possibility of installing automatic oscillographic equipment which will enable an analysis of the stability performance of this generator. If this apparatus is provided it is believed that an analysis of the data collected thereby will be of wide interest.

Simple Street-Lighting Substation

THE twin cities of Marinette, Wis., and Menominee, Mich., are served by one company, the Menominee & Marinette Light & Traction Company The street lighting supply installation of the Michigan city is controlled through a single pair of wires from a substation in Marinette, about 1½ miles distant. The control scheme is apparent from the accompanying drawing. Closing the



Scheme of controlling street lights from substation

switch *A* energizes the solenoid switch 1, causing the ratchet-operated drum to move into the first position. This contact operates type R.C.O.C. switch No. 7. The switch *A* is held closed for about five seconds, long enough to assure the functionizing of switch 1. The next closure of *A* operates switches Nos. 2, 3, 4, 5 and 6. When *A* is closed the third time switch, No. 7, is opened. On the fourth closure No. 6 is opened and on the fifth the rest of the type R.C.O.C. switches are opened and the

Remotely controlled street-lighting substation

master switch, No. 1, is reset. The control circuit is 115 volts, energized from the 1-kw., 2,300/110-volt transformer *B*.

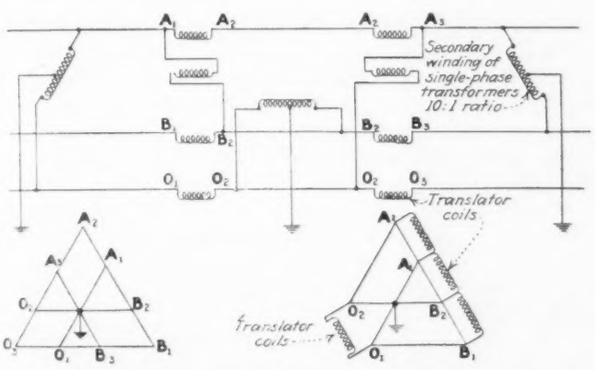
The installation includes three multiple and three series circuits. As shown in the accompanying illustration, it is entirely an outdoor installation. The integrating station total meter is contained in the box at the right of the constant current transformers and the series ammeters are in front of them. All the boxes have windows, through which the meters are read.

"Translators" Permit Operation of A.C. Network

By L. E. Karrer
Distribution Department,
Puget Sound Power & Light Company, Seattle, Wash.*

ONE of the objections which has been raised to four-wire delta alternating-current underground distribution is that such systems cannot conveniently be made into a grid network due to the necessity of balancing the lighting load between the three phases of the primary supply. Four-wire, 120/208-volt star systems, on the other hand, do not have this objection, but in the opinion of many engineers they are undesirable because of the low three-phase motor voltage.

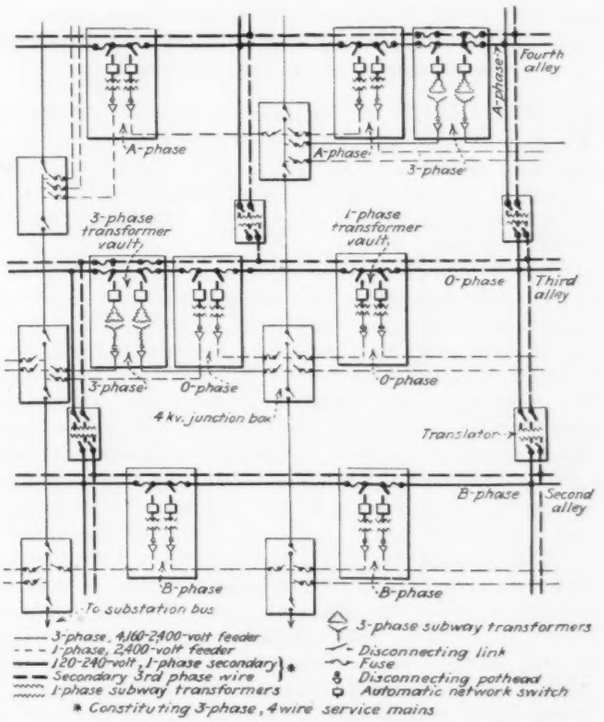
Some years ago the Puget Sound Power & Light Company installed a four-wire delta alternating-current underground system to serve the business district of Seattle. This system until recently operated with parallel sets of secondary mains served from different phases with no attempt at cross-ties to form a grid. The three-wire lighting mains are of heavy copper served by large single-phase transformers, the 240-volt legs of the lighting mains being used in conjunction with a fourth wire to serve small power loads.



Schematic and vector diagrams of translators for alternating-current networks

In order to cross-tie the secondary mains of the different phases to obtain the advantages of a solid secondary grid network and also to eliminate the necessity of additional transformers to supply small power loads, the company installed a number of 144-kva. "translators." The translator is a simple type of low-voltage autotransformer devised by Dr. J. C. Parker, and, as shown in the accompanying schematic and vector diagrams, it consists of four windings on the same core, which permits connections for offsetting three-phase delta voltages so that a common point may be grounded and a free interchange of energy between the three phases take place. The translator, in effect, compensates for the difference in voltage existing between similar points of the secondary network, i.e., A_1, A_2, and A_3, resulting from the grounding of the separate phases. Such a scheme not only constitutes an electrical tie between the single-phase secondary mains, allowing transfer of power crosswise as well as lengthwise of the network, but enables the three-phase, four-wire mains to be used for combined light and power service, supplying full 240 volts delta instead of 208 volts as obtained with the star system of connections.

In order to obtain information regarding the operating characteristics of the translators a load test was made by placing a representative three-phase power load at one extreme corner of the network after interconnecting it through the translators. As will be seen from the network diagram, a three-phase load would require transmitting power from two other sets of single-phase mains through the translators in addition to several blocks of secondary mains. This condition would produce the greatest unbalance of voltages and for this reason was most suitable for the test. Moreover, since each of the three phases serves single-phase lighting loads, the nature and extent of the lighting load would affect results.



Section of alternating-current delta network formed by the use of translators

This condition was taken into consideration by making separate tests, one during the heavy lighting load period and the other during the light load period of a typical day in order to secure equable results.

The artificial load consisted of a water rheostat with which it was possible to obtain a balanced three-phase load of 60 kva. The drop across the 240-volt lighting mains was 0.5 per cent, while the maximum drop on either of the two other phases was 2 per cent, indicating that the use of translators would result in satisfactory voltage regulation.

The actual results of the test were as shown in the following table:

Test No.	Reading	Line Current 1	2	3	Phase Voltage A	B	C
No. 1 10 a.m....	1	0	0	0	245	241	244
	2	160	160	160	244	239	239
No. 2 4 p.m....	1	0	0	0	245	241	244
	2	150	150	147	244	240	239

*Under management of Stone & Webster, Inc.

Translators permit the use of a less expensive type of single-phase transformer vault with single conductor primary feeder, using a common neutral for primary and secondary. Where a large three-phase load is to be served a three-phase transformer vault may be built close by and the three-phase transformers paralleled in on the secondary network, thereby relieving the translators of interchanging any large amount of electrical energy. With this system it appears that translators will prove satisfactory for interchanging power between phases and for producing a more closely interconnected secondary network and insuring greater stability and continuity of service.

Life Tests on Cable

Based on many present-day specifications, cable tests do not necessarily agree with best operating results. Need of tests that will more closely simulate operating conditions

EXPERIENCE of countless generations teaches us that devices with moving parts wear out, whereas sationary devices are subject only to the action of the elements. Hence, our natural prejudices incline us to expect insulation, which is protected from the elements, to last forever.

The electron theory, however, suggests that the wear of relatively moving parts is but a result of electron collisions and that if such collisions are excited by other means corresponding wear will be incurred. This is what happens in a live dielectric: The electrons are excited into motion and the dielectric started on its way to destruction, according to W. A. Del Mar, chief engineer of the Habirshaw Cable & Wire Corporation, who commented on dielectric breakdown before the research conference in Baltimore recently. Asked to elaborate on this thought, he said:

"There has been a belief, based on the old superstition that stationary objects do not wear out, that by writing suitable specifications the makers of dielectrics can be forced into making this belief a fact. The first stages of this attempt were characterized by specifying that cable dielectrics should have a chemical composition within limits which were found to be characteristic of those dielectrics which gave the best service. This is yet the usual basis of specifications for rubber insulation. The second stage differed from the first in relegating chemical composition to comparative unimportance and specifying arbitrary electrical and mechanical tests based on data characteristic of the most successful existing cables. Both of these stages of progress have been empirical to an extreme degree and there is a suspicion in the minds of many operating engineers that the specifications of the present day have failed to attain their object, or, in other words, that cables that show best on test do not necessarily give the best operating record.

Accelerated Life Tests Partially Empirical

"Some years ago it was found that in the case of rubber insulation the rate of deterioration from oxidation, as measured by loss of tensile strength and elasticity, is a fairly definite function of the temperature at which the material is kept, the rate increasing rapidly with temperature above 60 deg. C. Hence it is possible to estimate, with a fair degree of accuracy, the rate of deterioration of a rubber compound at ordinary temperatures from tests conducted at high temperatures. For instance, four days at 70 deg. C. were found equivalent to two years at ordinary operating temperatures. This test, known by the name of its inventor as the "Geer accelerated life test," has found considerable commercial application. The principle of this test marks a decided advance over the purely empirical method, but it must not be forgotten that its value depends on the assumption that the general relation on which the test is based represents not merely an average, but that the departures from the average in each case are insignificant. Hence, even the accelerated life test has an element of empiricism.

"More recently it has been found that the life of impregnated paper insulation, i.e., the time required to produce puncture, is inversely as the sixth or seventh power of the applied voltage. Hence, by making a life test of short duration at a high voltage, the life at ordinary voltages may be estimated with a fair degree of accuracy. This test is excellent as far as it goes, but it only measures the ability of the dielectric to carry voltage and completely neglects the thermal experiences to which a cable is subjected in service."

Many Factors Complicate Determinations

This was brought out very clearly at the recent meeting of the insulation committee of the National Research Council held at Baltimore in November. It there transpired that several of the utilities and manufacturers are engaged in an attempt to develop an accelerated life test, taking into account both the electric stresses and the thermal cycles which characterize cable operation. This means that test cables are to be subjected to excessive voltages and excessive temperatures for periods measured in days, in order to simulate the effect of normal voltage and normal temperature over a period measured in years.

Difficulty was encountered at the outset due to the lack of uniformity in the relation of the properties of cables at operating temperatures to properties at higher temperatures. Among these properties are dielectric loss, thermal expansion, electrical resistivity. As an example of how this lack of uniformity operates to spoil a life test such as outlined Mr. Del Mar suggests considering the effect of dielectric loss.

"Imagine," he says, "two cables with substantially equal dielectric-loss-temperature characteristics up to 70 deg. C., one of which maintains low losses up to 100 deg. C., whereas the other goes to a very high point at that temperature. The cable may be operated at not over 60 deg. C., so that if the two cables are equal in all other respects, they should rate equally in any reasonable accelerated life test. If, however, the life test is made over a thermal cycle extending to 100 deg. C., the cable with high loss at that temperature will fail long before the other from accumulative heating, whereas the other will not.

"Now it so happens that cables containing rosin often belong to the class characterized by high losses at high temperature, so that we are faced with the anomaly that a highly favored type of cable does not pass the test as well as cables which may give a poorer account of themselves in service.

"It is therefore clear that the temperature cycle cannot be increased as is done with the voltage in order to condense the history of years into a story of days. The best that can be done is to carry the thermal cycle over its maximum operating range and rely on the voltage for compressing the time. If such a test is developed it will go a long way toward rationalizing the cable specification situation."

Industrial Electric Heating

Recognizes potentialities of heating load, but declares electric utilities are occupied with other matters as well. Research in manufacturing processes and technique must precede application of electric heat

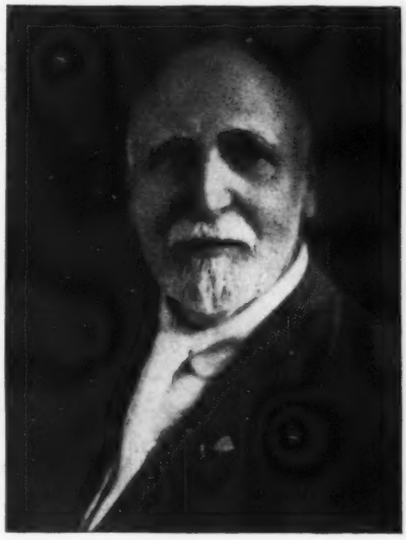
An Interview with

ALEX DOW

President Detroit Edison Company, Detroit, Mich.

WHAT is the matter with industrial electric heating? Are the central stations at fault? Are they suffering from myopic vision, failure to see the broad and verdant field that lies before them? Or is it the furnace manufacturers who have muffed the ball? Has the ball actually been muffed?

These questions, and various answers to them, are heard on every side. The trouble with most of the answers is that they are expressions of persons and parties who have interest in restricted phases of the situation, who do not see the entire picture. Desirous of obtaining a comprehensive opinion of the whole matter, a representative of the ELECTRICAL WORLD approached a man whose views are generally respected and recognized as being based on that comparatively rare foundation, common sense. This man is Alex Dow, president of the Detroit Edison Company, an electric utility that has been successful above the average in adding industrial heating load to its lines.



Alex Dow

"First," said Mr. Dow, "let us consider what has been done in Detroit. We serve a highly industrialized area in which heating load is to be found if it is to be found anywhere. We have got some of the load, not so much as we would like to have, probably not as much as we should have. The heating load now requires one-sixth of the total power consumption but only one-seventh of the total power demand. Both of these comparisons are approximate; they are based on estimated figures that include only those larger installations of which we have selling records, and do not include the thousands of smaller heating applications of which we have no account.

"A parenthesis should be inserted here. Practically everybody who talks for publication about industrial electric heating has in mind large units of load, hundreds and thousands of kilowatts. But there is another class of heating load that comes in small, sometimes fractional, units. In this class are glue pots, small muffle furnaces, light welders and such bric-a-brac. The total of these usually unconsidered increments will run to a very high figure. It is estimated that the Detroit Edison system load would be increased 15 to 20 per cent if every small shop and factory in its service area that had use for a number of such devices were supplied with them. Here is a promising field for direct advertising and customer education. Any utility might enter it without any of the misgivings and qualifications that usually inhibit it from making the same kind of aggressive effort to take on the larger units.

"The increase of the industrial heating load on our system has been one of natural accretion rather than building by widely applied and general effort in advertising and educational campaigns. This accretion has come about from our interest in specified problems of our customers. Ten years or more ago we had one and sometimes two men who devoted their entire attention to electric heating. This special attention was not so much on account of the immediate possibilities of load increases in this field as to the fact that electric heating was then in the infant stage and it required development and research that the company felt called upon to perform. In the past later years, and now, the company has taken the position that development and research have properly moved into more interested hands and it now treats electric heating as a regular power sales job. There is still, however, much specific work to be done in fitting equipment to a definite job, and in this we go along with our customer until his problems are ironed out. The power sales staff includes a metallurgist, lately recruited, who will look after special applications in his line. But there are many other important heat applications and these are covered by the nine regular power salesmen, who devote probably 10 per cent of their time to this work.

"An important contributing factor to the growth of the industrial heating load in Detroit is the so-called 'primary' service and rate form by which any customer with a demand of 100 kw. or over may receive service at 4,600 volts on a strictly load factor rate. The energy charge in this rate is low; it encourages the long-hour use that is a natural attribute of the electric furnace. If a customer can so arrange his factory processes that little or none of his furnace demand is coincident with his power demand he can use his heating equipment at a ridiculously low electricity cost. An added argument

to persuade the customer to keep furnace and power demands separated is that he owns the transformers through which he is served. Additional transformer capacity is a direct out-of-pocket expense to him and is not merely a reflected and more or less distributed cost collected by the supply company.

"The electric heating load is growing in Detroit. We are doing what we think is best to encourage and promote that growth. In its efforts along this line it is necessary that each central station should make large use of discretion and apply to best effect its knowledge of and experience with local conditions. A knowledge of the production processes of its customers and an acquaintance with the probable trend of development in those processes is essential if a utility is to go about increasing this class of load intelligently. We are trying to do this in Detroit.

"With specific reference to conditions in the furnace manufacturing industry there are two general criticisms to be made. They are of business ethics and of equipment design.

"The industrial heating situation would be improved if about half of the manufacturers went out of business, among them those who do not conduct their selling in a consistently business - like manner. In their anxiety to make sales they will cut prices and make extravagant guarantees that cannot possibly be lived up to. In one case reported to me a furnace manufacturer offered to guarantee a definite unit cost of product on the shipping platform of the user's factory without the slightest knowledge of the other factors that, in addition to the heating process, entered into that unit cost. In another reported instance the original bids for electric heating equipment averaged a certain sum and the installation was finally made at a cost to the buyer of about half of that average, and this figure was considerably less than the lowest of the original bids.

"An offense against ethics on the part of furnace manufacturers is lack of complete candor in regard to the performance of their several devices. There is too much disposition to offer general statements that may give the prospective user wrong impressions and too little definite information is offered to him on what a furnace will do, and particularly will not do, under the conditions in which he desires to use it.

"The second criticism, referring to design of equipment, is based on the very bald fact that much equipment is not fitted for the work it is sold to do. Both electrical and mechanical design are included in this animadversion. The reason for this condition is easily apparent: the business is comparatively new and the proportion of uninformed enthusiasm to established data is high. This is a reason for the condition, but it is not a reason why it should be tolerated and permitted to continue indefinitely.

"But, in spite of bad ethics, bad design and the inevitable consequences being frequent enough to call aloud for correction, the electric furnace business is fundamentally sound. There are many manufacturers who are immune from such charges. Electric heating is justified in economy, in quality of product and in adaptability to production processes in a continually growing list of industrial applications. As a general proposition the central station knows this and they are going forward with heating load development with faith and vigor proportional to their individual acceptance of the fact. The average of this acceptance is high, and considering it in relation to other classes of load one cannot say that the electric utilities are overlooking the possibilities.

"There is one thing the manufacturers should take into proper account in their estimation of the part the central stations should take in heating load development. It is the thing that they most often take into improper account. Industrial heating is not a single subject of definite limits that can be included in the education and experience of one man. It is a collection of many subjects of varied and diverse natures. If a man takes the time to become really expert in one main branch of heat application he will not find time during his span of life to learn all there is to know about very many others. Yet the furnace manufacturers evidently expect the central-station sales departments to cover in exact detail every phase of industrial heat application. Possibly if a twentieth century counterpart of Leonardo Da Vinci could be assigned to each and every central station this expectation might be realized. Some day we may have our universal sales engineers who can say how a forging of alloy steel should be best treated and put on overalls and boss the job successfully and the next afternoon show my lady just the right lighting combination for her tea party. I would file a requisition for my quota of these supersalesmen if I knew where to address it and if I did not know that the process of producing a practical magician must begin with his grandparents.

Electric Heating Load in Detroit

THE figures of heating load in this statement are all estimated. They include only those installations that are served by the Detroit Edison primary power system and take no cognizance of the very large load furnished by miscellaneous small industrial heating devices.

Total energy for heating, twelve months to Sept. 30, 1928, kw.-hr.	183,980,000
Total energy for power (including heating) twelve months to Sept. 30, 1928, kw.-hr.	1,162,159,600
Heating demand, kw.	42,630
Power demand (including heating), kw.	289,000

Heating Load Connected (Kw.)

	January, 1926	November, 1928
Steel melting	3,900	4,900
Brass melting	10,045	9,320
Heat treating	16,320	29,500
Japanning	21,584	12,050
Totals	51,849	55,770

The small difference in the totals does not accurately measure the development of the load. The falling off in japanning is caused by the introduction of Duco and other cellulose metal finishes. This drop is more than compensated for by the increase in heat treating, which is probably the widest field for industrial electric heating applications. Although the increase in steel melting is not great, this use, after heat treating, appears the most promising.

"Now, in regard to the general situation, I believe there are two causes for the relatively slow development of the electric heating load. These are the central stations and the large manufacturers of electrical equipment and apparatus. The history of both has been essentially the same. They have been almost wholly occupied in supplying the demands made upon them and they have had little or no time to think of, much less actively develop, new fields for their services and products. They are only now slowly awakening to the possibilities of the electric heating load; the central station to the enormous energy outlet it affords and the manufacturers to the additional apparatus required to serve it.

"With such minimizing of interest in two parties that stand to profit from electric heating it is not remarkable that the furnace industry has grown up, so far as it can be said to have grown up, in a helter-skelter, hit-or-miss fashion with no great responsibility back of it. Electric furnace manufacturing has not been a profitable business from the start. As a matter of fact, only a few furnace manufacturers are making money at the present time and they have been doing it for only about three years.

Practicability Being Determined with Less Delay

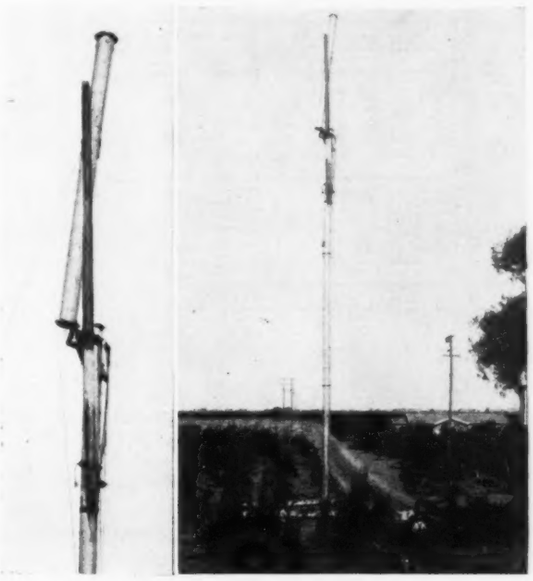
"The proper development of industrial electric heating requires research into industrial processes and technique on a large scale and at a high cost. While the existence of this problem may have been, probably was, realized by many at the very beginning of electric heat applications, yet it was neglected by those most competent to do the job and most directly concerned in getting it done. As said earlier, this neglect was caused by preoccupation with more instantly important matters. It might be stated that the function of research is to discover whether a thing will work before it is put into actual practice. From this definition one can say that research in industrial electric heating has been very slight because most of the lessons regarding workability of ideas and designs have been acquired in attempts at actual practice. This was a natural condition in a field occupied largely by manufacturers who may have been short of both capital and experience. They were forced to make their experiments on the property, and sometimes at the expense of their customers.

"This condition is now changing, for the reason that at least some of the furnace manufacturers are making money and can assume their rightful burdens of experiment. But it will have to change rapidly and radically before serious efforts can be made to realize the full potentialities of the industrial heating load. Complete development of the heating load has been variously estimated, but there is no doubt that it is of much greater magnitude than the present or future power load. The rapid and radical change in the furnace industry that must precede the fullest development of the heating load will be brought about, when it does occur, by a vision or a fear of the market for our service turning from a sellers' heaven into a buyers' paradise.

"In summing up," said Mr. Dow, "I do not believe that there is anything more wrong with industrial electric heating than there would be with any other business that was thrust upon a group of men who were extremely busy with other affairs. Those who are most vociferous about the great future of the heating load should not lose sight of the fact that there are other John the Baptists crying through the wilderness of apparent indifference, heralding new gospels of domestic load, lighting applications, refrigeration, cooking and a host of others. In the electric utility industry, it cannot be said that 'there is a time for all things'; we have to attempt the impossible and keep all things moving at once."

197-Ft. Tubular Steel Poles for River Crossing

SAVING in both time of erection and total cost was effected by the Great Western Power Company of California by using tubular steel poles as illustrated for transmission line supports for lines over a navigable stream. The pole shown in the process of erection will



Substantial support for transmission line river crossing

be 197 ft. in height, composed of 25-ft. sections of 16-in. steel pipe flanged and bolted and guyed every other section.

Four steel crossarms will carry one No. 3/0, 22-kv. circuit; one No. 4, 22-kv. circuit; one No. 4, 4-kv. circuit and a position for a telephone line. Steel poles of this type are displacing spliced wood poles formerly used.

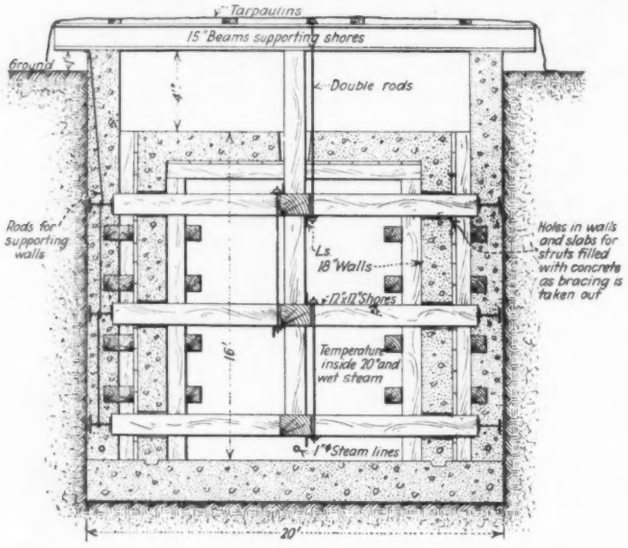
Cost of Station Lighting Installation

		Per Unit	Total
Novalux bracket type fixtures	4	$12.9375	$51.75
Labor, installing	....	.....	500.20
No. 6 rubber-covered wire, ft	60	0.0352	2.11
No. 10 rubber-covered wire, ft	500	0.014	7.00
No. 12 rubber-covered wire, ft	1,000	0.015	15.00
Miscellaneous material	....	.....	38.27
Pine wood, 1¼ in. x 8 in., ft	19	0.0984	1.87
Miscellaneous hardware	....	.....	0.18
Holophane lighting units No. 661	7	16.03	112.21
No. 10 rubber-covered wire, ft	2,000	0.01	20.00
No. 12 rubber-covered wire, ft	309	0.01	3.09
Sheraduct, ½ in., ft	50	0.15	7.50
Sheraduct, ¾ in., ft	20	0.19	3.80
Flexible conduit ¾ in., ft	100	0.08	8.00
Bowl enameled lamps, 1000 watts	8	2.48	19.84
Bowl enameled lamps, 500 watts	2	1.35	2.70
Bowl white lamps, 300 watts	6	0.84	5.04
Clear lamp, 200 watts	1	0.51	0.51
Miscellaneous material	....	.....	28.90
Transportation expense	....	.....	0.96
Additional labor	....	.....	6.56
Liability insurance	....	.....	0.35
Total			$836.34

Steam-Heated Concrete

By D. G. Morrison
Construction Bureau, Detroit Edison Company, Detroit, Mich.

CONCRETE poured during cold weather must be protected from freezing if it is to be good concrete. The usual practice is to inclose the pour with a protective covering and to keep a number of salamanders going inside the inclosure for a few days. In structures where



Steam used to cure or to prevent freezing of concrete

form work bracing is thick and complicated the salamanders constitute a distinct fire hazard if the watchman on the job becomes careless or something else goes wrong. The Detroit Edison Company uses steam for curing concrete on its construction jobs wherever this is practicable.

The method used is illustrated by the sketch here reproduced, which is intended to show a section of the circulating water intake of Delray power house No. 3, poured last winter. A canvass cover was fastened over the intake from the sheet piling on each side. One-inch pipes, each with a row of $\frac{1}{8}$-in. holes bored along their lengths, were laid in as indicated in the sketch. The steam was supplied from a donkey boiler of the type common on large construction jobs. It was applied for three days, during which the concrete became thoroughly set. Compressive strength of concrete test cylinders was what the design called for in 28 days. A central heating plant reduces number of men from that required when salamanders are used.

Repairs at Home or Abroad?

A RECENT brief survey of electrical repair practice policies in some fifty New England power systems revealed a widespread tendency on the part of operating men to turn a considerable part of this work over to specialist organizations. On some properties comparatively remote from the manufacturing plants which supplied them with their original equipment a great deal of "home-talent" repair activity is utilized effectively, but there seems to be a general preference in many companies, regardless of size, to care for very light repairs at home and to ship readily portable equipment to manufacturers' service stations or to commercial repair establishments. Heavy generating machinery may or may not be dismantled for repairs at a distant point, depending on conditions, but transformers, motors and other apparatus except meters are quite generally sent away. Seldom, apparently, does this kind of work "head up" through a single department engineer executive who devotes any considerable time to the intimate study of repair costs, time elements and policies desirable under different conditions.

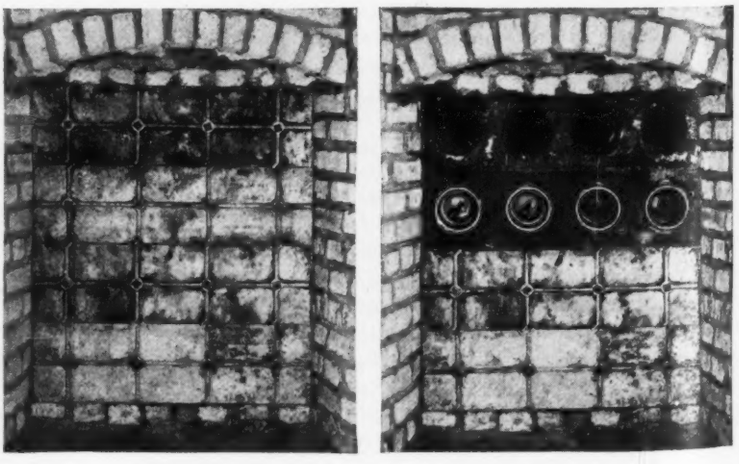
It would appear that here is a field for comprehensive investigation. "Repair dispatching," as it might be called, is at present rather haphazard on many properties.

Economy in Duct-Bell Installation

By C. A. Jacques
Engineer Conduit and Cable
Public Service Company of Northern Illinois, Chicago, Ill.

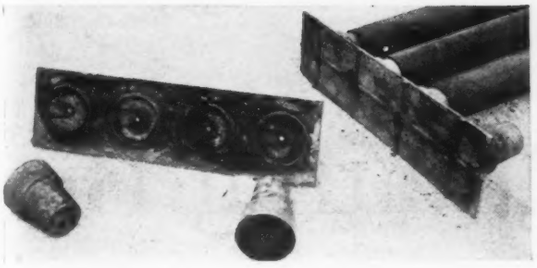
A HIGHLY economical and effective method for the installation of end bells for duct entrances into manholes in now being used by the Public Service Company of Northern Illinois. The equipment consists of galvanized iron bell forms and holders, cast separately and with machined edges so that they may be bolted together, making an even, smooth-surfaced form. The bell forms are tapered slightly at the inner end and are placed securely in the end of the duct, leaving a smooth, even taper from the duct in the finished bell. The form holders are made one duct high and in three sizes, two, three and four ducts wide, an arrangement which readily permits the installation of bells in sections of from two to 24 ducts.

Upon installation, the pockets in the manhole are built wide enough to accommodate the holder for the width of the conduit section being laid. The forms are first painted with grease or soapy water, then the assembled holders and forms are set in place with the forms inserted in the ends of the ducts. After the assembled bell units have been accurately placed in position a 1:2 mix of cement mortar is well tamped around the forms, and additional rows of ducts and forms are set and the pouring continued until the desired section has been built up. The ducts are aligned vertically and horizontally by



End bell forms in place and partially removed

One top form is shown removed, at the right, but only the holder has been taken off the second row of ducts, leaving the separate bell forms.



Bell forms and holder disassembled and method of inserting forms into duct ends

means of cleats cast in the holder which interlock automatically, giving the finished end bells a uniform spacing at a predetermined horizontal and vertical spacing. The weight of the forms, while not excessive, is sufficient to hold them firmly in place. The forms and holders are allowed to remain in place about twelve hours and then removed from the finished cement bell.

In the experience of the past two years the cost of end bells constructed in this manner has been found to be only a small percentage of the cost of other types. Due to the use of this type of end bell, the over-all length of the manhole from duct mouth to duct mouth has been increased considerably with no additional manhole cost. Other advantages include the reduction of cable trouble at the duct mouth, ease of fireproofing cable back into it and the ability to train cable at a minimum radius without fear of sharp bends.

Portable Office and Tool Storage

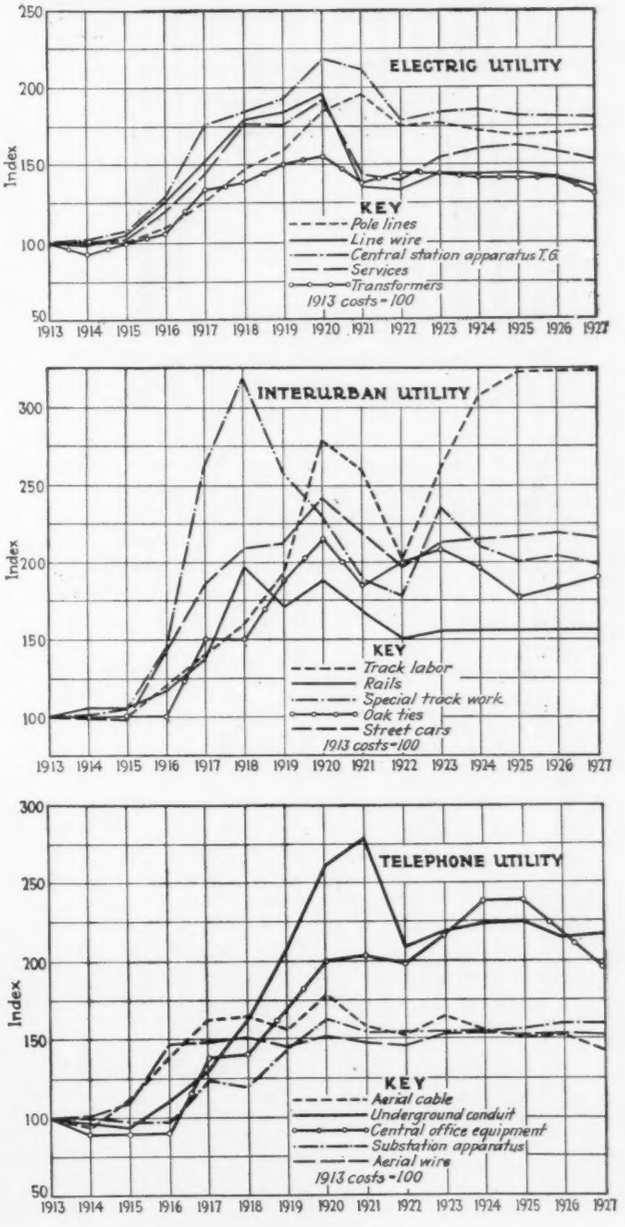
By Theodore R. Eilenberg
Structural Engineer
New York & Queens Electric Light & Power Company

THIS field office on wheels is considered a big improvement over the ordinary portable type of shanty by its owner, the William F. Kenny Company, contractors. It is 15 ft. long by 8 ft. wide and contains an office and a tool storage compartment. The latter measures 4 ft. 6 in. by 8 ft. The office has desk room for three men and ample space for the keeping of records, storage of plans and hanging of clothes. A telephone is installed that can be hooked up readily at new locations. The tool compartment eliminates the necessity of tool boxes and carts and permits storing the tools where they can be easily watched.

To move this shanty it is only necessary to hook it on to a tractor. As a result it can be moved along with the job. The chassis was purchased from a wagon concern at a very reasonable cost and the shanty added.

Reproduction Costs of Electric Utilities

CHANGES in reproduction cost of several major divisions of public utility properties since 1913 are shown on the accompanying charts, prepared by the American Appraisal Company of Madison, Wis. Corresponding charts for water and gas utilities show fluctuations similar to those of the electric, but their present

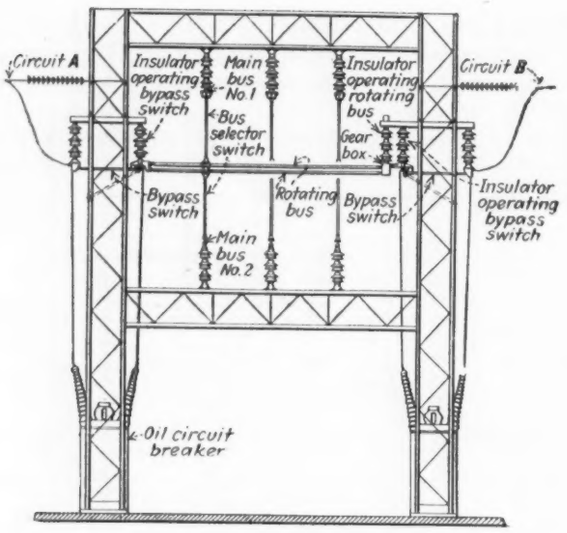


Fluctuations in cost of reproduction of electrical, interurban and telephone utilities

These costs represent average equipment and average prices for various parts of the country. They suggest but do not specifically indicate fluctuations for any given utility. 1913 costs = 100.

indices are on the whole somewhat higher. Apparently the electrical field has been able to combat increased labor and material costs more effectively than others.

Agreement between the cost changes as made above and those indicated in the article "Reproduction Costs of Physical Properties" in the Electrical World, Sept. 22, 1928, page 590, may be noted.



Typical section across main bus

Geared mechanism, operating through rotation of insulator stacks, rotates buses and opens and closes switches.

Rotating Buses

of Outdoor Su

A RADICAL change from customary design is evident in the new type of substation ordered by two large utilities for early delivery from the Delta-Star Electric Company. The rotating buses, which characterize this new design, reduce the number of insulators required by 50 per cent, simplify the construction and save ground space.

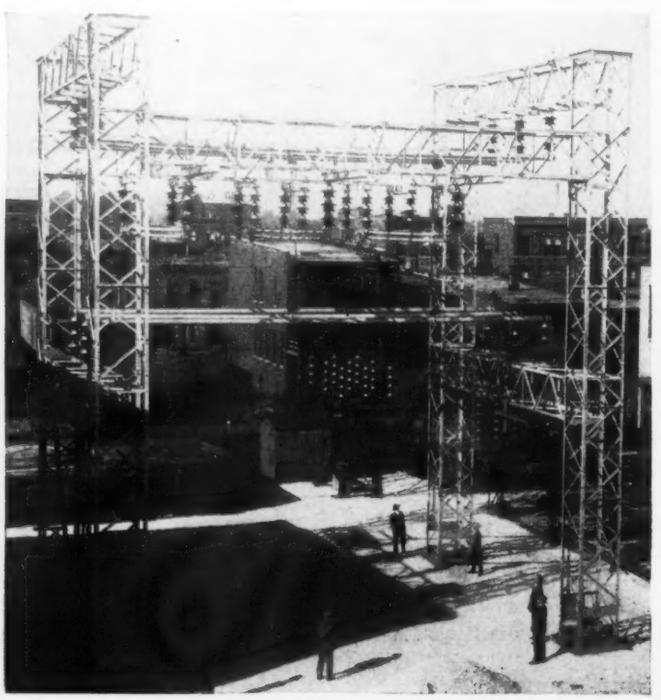
As pointed out by H. W. Young, president of the Delta-Star Electric Company, "The ideal station would be one where all 'idle' connections and all 'idle' insulators are eliminated. . . . Instead of running connections from two buses to a set of bus selector switches mounted elsewhere on the steel structure, these switches are so designed and placed that in themselves they form the tap-off connections from buses to the disconnecting switches for the oil circuit breakers. The stationary contacts for the disconnecting switches are mounted on the buses themselves. . . . There are two rotating buses for each phase, one supporting blades for the upper main bus, the other blades for the lower main bus. The two buses of the same potential are supported on insulator stacks which serve also as operating means for the selector switches.

"As all 'idle' connections between buses and disconnecting switches as well as between disconnecting switches are eliminated, a considerable saving is accomplished in conductor materials, insulators and space, making it possible to reduce the supporting steel structure and ground space to a marked degree. The cost of erecting is reduced to a minimum as the only connections made in the field are those from the incoming line to the disconnects and the vertical connections from the dis-

ROTATING BUS DESIGN SAVES GROUND SPACE

Type of Station	Average Length 66 Kv.	Average Length 132 Kv.
Composite	77 ft.	104 ft.
Sectional	111 ft.	145 ft.
Type "F"	34 ft.	43 ft.

Note—The height and width of the three stations are approximately the same.



New type of substation eliminates many parts

Application of the principle of rotating buses to outdoor substation design not only eliminated "idle" connections and parts but permitted savings in ground space, and in this skeleton set-up the number of insulators required was reduced from 100 to 50 for comparable service

eSimplify Design

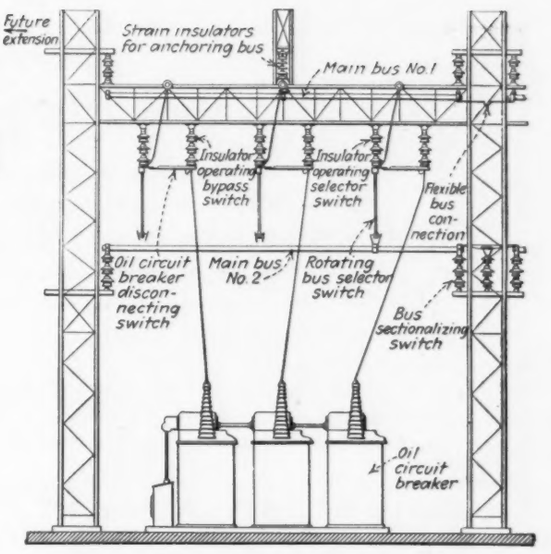
loor Substation

connecting switches to the oil circuit breakers. The design also permits a simple steel structure with minimum of steel details. All bays are alike and symmetrical about a center line."

The switchgear is designed to be mechanically flexible and self-aligning, preventing binding in bearings, or similar difficulties. The lower end of the insulator stack operating the selector switches is equipped with an intermittent gear box bearing, into which both carriers are connected. Through this gear box proper operation of the switches is assured for transferring loads from one bus to another; that is, the gears are so arranged that the buses must be parallel before transferring the circuit.

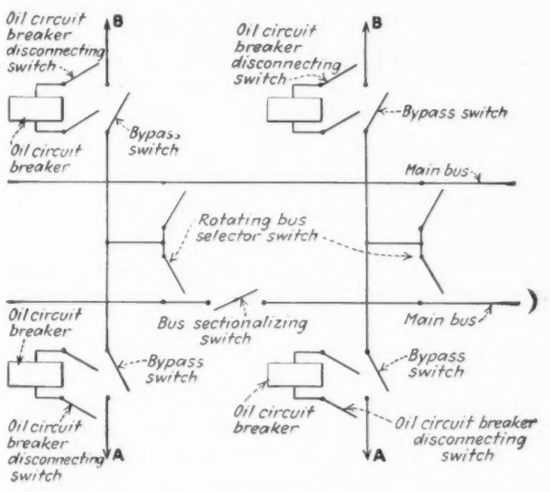
The two insulators for the vertical-break switch also serve the double duty of supporting the stationary contacts for the oil circuit breaker disconnecting switches. These switches are of the single horizontal-break type, both blades swinging in the same direction.

All connections to an oil circuit breaker are fastened to the rotating insulator stacks of its disconnects. This grouping of disconnecting switches, in connection with the rotating bus switches, forms a condensed arrangement, using a minimum number of insulators.



Station bays are alike and symmetrical

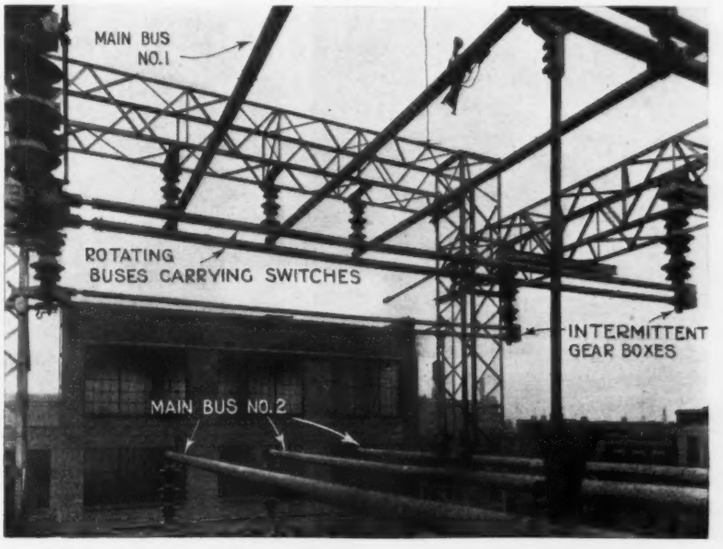
The rotating bus forms a rigid connection supporting the vertically swinging blade of by-pass switches which are mounted on a single insulator stack at swinging end.



Switching arrangements of rotating-bus station

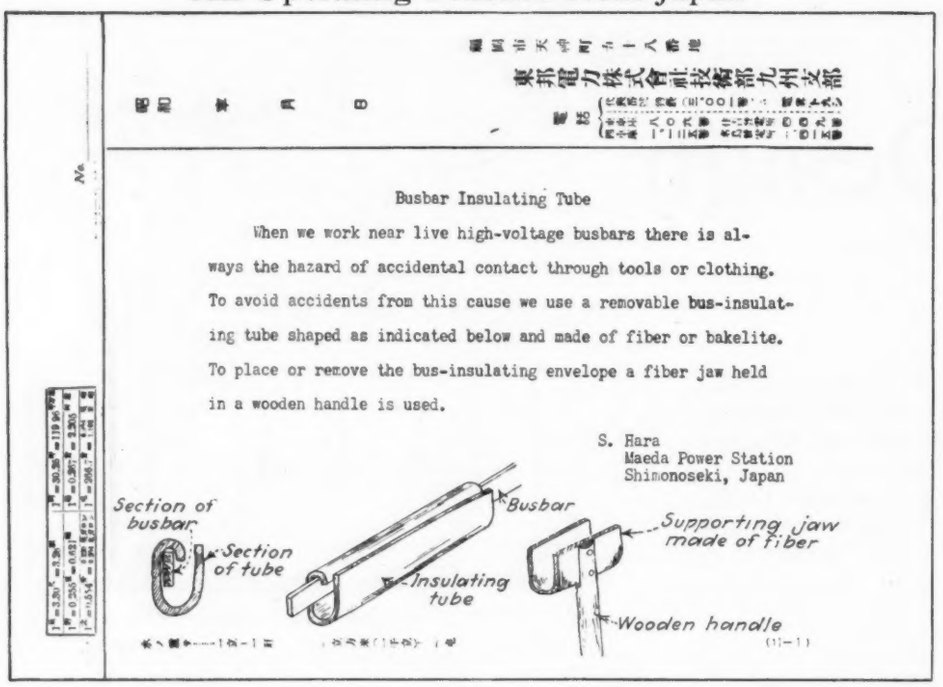
As indicated in the single-line diagram, this plan permits grouping two circuits on the same set of bus selector switches, making it possible to feed from one circuit to the other with both selector switches open, entirely bypassing the buses, so that oil circuit breakers may be by-passed without sacrifice of circuit protection.

Switch contacts have been made integral with bus structures and selector switch blades attached to rotating buses minimize the material requirements for outdoor substation construction



Rotating buses offer basis for new station design

An Operating Practice from Japan



Busbar Insulating Tube

When we work near live high-voltage busbars there is always the hazard of accidental contact through tools or clothing. To avoid accidents from this cause we use a removable bus-insulating tube shaped as indicated below and made of fiber or bakelite. To place or remove the bus-insulating envelope a fiber jaw held in a wooden handle is used.

S. Hara
Maeda Power Station
Shimonoseki, Japan

Compact and Complete High-Line Truck

THE live-line maintenance truck illustrated was designed by K. B. Crawford, general superintendent of lines of the Pennsylvania-Ohio Power & Light Company, and by M. F. Banks, superintendent of the Youngstown line division of the same company. The truck has a 1½-ton G.M.C. chassis with a cab supplied by the American Coach & Body Company, Cleveland, Ohio.

On the left side are weather-tight racks for hot sticks, "jew" claws, portable crossarms and tie sticks. The fiber conduit tubes in which the tools are carried do not mar the finish or preservative of the hot sticks. In the rear center of the truck platform is a handle, replaceable by a pulling hook for assistance in climbing in and out.

Back of the cab is a box to carry insulators packed in sawdust to prevent breakage. By removing the box a winch can be installed and a pole derrick attached to fastenings at the rear of the truck. On top of the cab is the ventilated rubber goods box. By having the seat for the crew on one side of the truck only, the other side is left free for ropes and blocks. On each side of the safety-tread platform step, and slightly above it, are two tubes for carrying digging bars and long-handle shovels. Just above the safety pintle hook (for hauling a trailer) between the body stringers is fastened a metal pan in which are carried ground wire protectors, coils of guy wire, etc.

A box on the rear right side carries hand tools. Next forward are adjustable compartments for small hardware. Below this compartment is space for heavy tools and heavy articles of hardware. In the upper left corner of this box is a compartment which runs across to, and can be reached from, the opposite side of the truck. In this space are carried cant hooks, axes, chains, etc. This compartment is metal lined to prevent wear. A water keg is carried on the right front fender, where it is both readily accessible and easily removed.

On the left side of the truck are two small compartments; the front one is used as a foreman's box, in which he carries his report sheets, sketches, blueprints, etc. The next box is for carrying the blowtorch and solder ladle. In still another compartment are carried the men's belts, spurs and safety straps, all being separated so that the safety straps will not be cut by the spurs. The truck has been designed to be both compact and complete and to avoid excessive equipment handling.

Each item of equipment has its readily accessible place on this live-line maintenance truck

Providing for Peak Loads*

The problem of the annual peak load in steam power stations is analyzed and possible expedients for handling are discussed. Steam accumulators economical under certain conditions.

By A. G. CHRISTIE
Professor of Mechanical Engineering Johns Hopkins University

A POINT is soon reached in electrical systems with growing loads when additional generating capacity must be installed. The choice may lie between additional boiler-house equipment and another standard high-pressure turbo-generator, steam accumulators and a special turbo-generator to carry fluctuations and peak loads, or a special peak-load turbine and boilers.

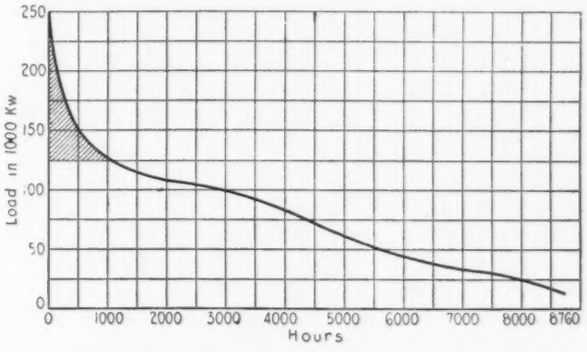
A study of load-duration curves leads to the formulation of two statements regarding peak-load equipment in a generating system: (a) Plant intended for peak-load service only should be installed at the lowest possible first cost; (b) economy of peak-load equipment can be sacrificed to secure low initial cost. The first statement is evident from a consideration of the few hours of service of this portion of the system during the year. The second follows from a consideration of the small amount of power generated by such peak-load equipment. The cost of each kilowatt-hour thus generated consists predominantly of fixed charges, with relatively smaller charges for fuel, labor and maintenance.

Several Expedients Possible

Old stations on a power system often offer possibilities of increased capacity for peak-load service. Many have stokers with low settings and old equipment. Some of these may be changed to powdered-coal firing with unit mills, water-cooled furnace walls, evaporators, air preheaters, and radiant-type superheaters, and the output of the boiler plant can thus be greatly increased during peak loads. If adequate cooling water is available, the old turbines may be rebuilt for greater steam capacity at peak load. Small turbines may be replaced by new, larger, peak-load units. Generators may also be rewound for added capacity, or may be replaced by units of larger output. Such changes will materially increase the capacity of an old plant as a peak-load station, and the resultant gain in system capacity may be secured at a lower total cost than by any other plant which will provide the same additional capacity.

When new and highly economical boilers and turbines are added to a power system and are operated as base-load units during the early years of their use, the capacity factors of the older equipment are decreased. The question now arises, whether the installation of cheap, rugged units of large capacity for peak-load service only, in place of highly efficient base-load units, would be economically justified. It is also desirable to determine whether such peak-load units would provide lower costs than a steam-accumulator plant.

These peak-load turbines are of simple design and moderate efficiency so that as great an output as possible may be secured from a given frame, thus lowering the first cost per kilowatt of capacity. Condenser equipment for moderate vacuum may be installed. Peak-load boilers could be either oil fired or provided with water-cooled walls, large furnaces, and unit pulverizers for quick starting, low stand-by costs, and maximum ratings during their short daily periods of operation.



Load-duration curve for system with 30.4 per cent annual load factor

The load-duration curve represents the cumulative duration of all loads throughout the year. Each point on the curve indicates the hours per year that the load has not been less than the kilowatts represented by the point.

Loads in excess of 50 per cent of the maximum peak occur for only 1,050 total hours during the year, while loads in excess of 75 per cent of the maximum peak exist for only 200 hours in the year. The kilowatt-hours generated by the equipment employed to carry load in excess of 50 per cent of the maximum peak and which is shown by the cross-hatched area on the diagram represents only 4.8 per cent of the total annual output. The equipment carrying load above 75 per cent of the maximum peak produced only about 0.5 per cent of the total kilowatt-hours generated.

Accumulators Increase Load Capacity

A boiler plant which has been subject to wide fluctuations in load can generally carry a steady load of much higher average capacity with less difficulty and at better efficiency. Hence the addition of steam accumulators would improve the performance of older boilers, and would also save the cost of additional boilers, boiler house, and coal handling and other equipment. Accumulators are generally placed out in the open with no housing or any construction other than the supporting concrete foundations and the necessary piping and valves.

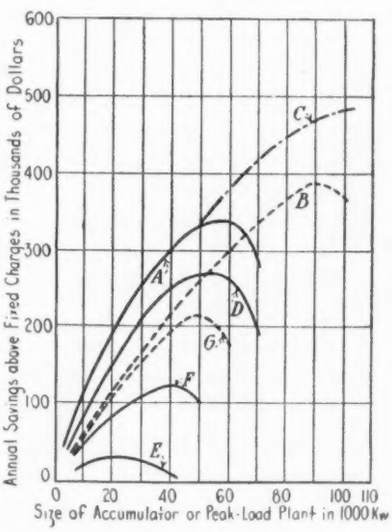
Steam turbines for accumulators are usually operated on saturated steam at moderate pressures, which permits the use of cast-iron casings. The low annual load factors for peak-load service will not warrant refinements in the design of turbine or condenser plant, and these for use with accumulators should be little, if any, more expensive than similar plant for peak-load service at standard pressures. Some operating advantages may be secured at slight additional cost by making the accumulator

**Excerpts from a paper presented by Professor Christie at the recent annual meeting of the American Society of Mechanical Engineers.*

turbine a mixed-pressure turbine capable of operating steadily in emergencies on steam direct from the boilers, or de-superheated.

Steam accumulators are suitable for peak-load service when the peaks are sharp and of short duration. The accumulator loses its advantage if the base of the peak that it is to carry exceeds four hours. Studies have been made on load curves with sharp annual peak loads such as occur in some cities with large lighting loads. Calculations indicate that peak-load units are less economical than an accumulator plant except in the large sizes. On the other hand, the availability of peak-load units for emergency service, particularly in the case of long-sustained peak loads on dark days, is greater than that of the accumulator. The same degree of availability may be secured on the accumulator turbine by making it a mixed-pressure unit.

The load-duration curves of systems with broad, flat daily peaks may show a certain portion of the annual peak which has a low annual load factor. The long duration of such daily peaks will favor the installation of a peak-load plant in preference to steam accumulators.



Annual savings with 45 per cent annual load factor and $5 coal

(*A*) Steam accumulator over addition of base-load plant to standard plant. (*B*) Peak-load unit over addition of base-load plant to standard plant. (*C*) Combined accumulator and peak-load plant over addition of base-load plant to standard plant. (*D*) Steam accumulator over addition of standard unit to standard plant. (*E*) Steam accumulator over addition of base-load unit to system with standard plant and old low-efficiency plant. (*F*) Steam accumulator over addition of base-load unit to system with standard plant together with older plant of moderate efficiency and still older plant of low efficiency. (*G*) Steam accumulator over addition of base-load unit to system with a series of units with efficiencies decreasing from the standard plant to the very old plant.

The differential between curves *A* and *B* at any size of accumulator or peak-load unit remains constant for that particular size. Curves have not been drawn for annual savings with peak-load units for conditions represented by curves *D*, *E*, *F* and *G*, as this would confuse the diagrams. The savings by the use of peak-load units with these combinations can be found by deducting the differential between curves *A* and *B* from the curve of accumulator savings for the particular system in question.

A steam-accumulator plant could carry peak loads other than during the annual peak, and this would lead to station economies due to the operation of fewer boilers and standard turbines. The charged accumulator is also available for emergencies during the off-peak hours such as thunderstorm peaks, fog, etc. The charging of the accumulator with steam during the night would improve the load on the boilers, and this should lead to more efficient boiler-house operation during that period. Accumulators require little maintenance and repairs, and this cost will be less than for the equivalent capacity of the boiler plant. Accumulators are subject to little wear and tear, hence their rate of depreciation should be less than that of a similar capacity of boiler plant. No financial credit has been given to the accumulator plant in this discussion for any of these savings, although it is reasonable to expect that these may be of a substantial size. The annual savings shown by the various curves refer only to the annual peak load of the system.

The accumulator, with its lower first costs, saves in fixed charges. The base-load plant saves fuel. The net sayings depend on the relative values of these two savings and, as shown by the various curves given in the paper, may amount to a large sum of money.

An important point shown by curves *A*, *B*, *C* and *D* in the accompanying figure is that steam accumulators and peak-load units effect their largest savings when added to a system consisting of standard plant with modern equipment only. Accumulators have usually been considered for addition to systems with older plants, whereas this study indicates that they can effect the largest savings when applied to systems with the most modern plants, provided these carry sharp peak loads.

Steam Accumulators vs. Base-Load Units

(Comparison of Yearly Costs)

Steam-accumulator plant (20,000 kw., cost $67 per kw.):	
Fixed charges, $0.15 \times 20{,}000 \times \$67$	= $201,000
Fuel at 1.5 per cent annual load factor (30,000 B.t.u. per kw.-hr.) $= 0.015 \times 8760 \times 20{,}000 \times \frac{30{,}000}{12{,}500} \times \frac{\$5.00}{2000}$	= 15,768
Standard Plant (180,000 kw.):	
Fixed charges, $0.15 \times 180{,}000 \times \$100$	= 2,700,000
Fuel at 72.2 per cent annual load factor (14,985 B.t.u. per kw.-hr.) $= 0.722 \times 8760 \times 180{,}000 \times \frac{14{,}985}{12{,}500} \times \frac{\$5.00}{2000}$	= 3,411,933
1 extra operator, 0.60×2920	= 1,752
Total annual cost	$6,330,453
Base-Load Unit (20,000 kw.):	
Fixed charges, $0.15 \times 20{,}000 \times \$115$	= $345,000
Fuel at 80 per cent annual load factor (14,150 B.t.u. per kw.-hr.) $= 0.80 \times 8760 \times 20{,}000 \times \frac{14{,}150}{12{,}500} \times \frac{\$5.00}{2000}$	= 396,653
Total kw.-hr. generated (*a*) $= 0.65 \times 8760 \times 200{,}000 =$ 1,138,800,000	
Total kw.-hr. on base-load unit (*b*) $= 0.80 \times 8760 \times 20{,}000 =$ 140,160,000	
Total kw.-hr. on standard plant = (*a*) — (*b*) = 998,640,000	
Annual load factor, standard plant $= \frac{998{,}640{,}000}{180{,}000 \times 8{,}760} = 63.33$ per cent	
Standard Plant (180,000 kw.):	
Fixed charges, $0.15 \times 180{,}000 \times \$100$	= 2,700,000
Fuel at 63.33 per cent annual load factor (15,180 B.t.u. per kw.-hr.) $= 0.6333 \times 8760 \times 180{,}000 \times \frac{15{,}180}{12{,}500} \times \frac{\$5.00}{2000}$	= 3,031,711
6 extra operators, $6 \times \$0.60 \times 2920$	= 10,512
Total annual cost with base-load unit	$6,483,876
Total annual cost using steam accumulator	6,330,453
Annual saving by the use of steam-accumulator plant above fixed charges	$153,423

A second striking fact is the large margin of saving that may be secured by the use of accumulators in place of base-load plant to carry annual peaks with any plant combination when the annual load factors are low.

A third point of interest is that the lower the price of coal, the larger the accumulator savings in systems with old and mixed plants, as shown by comparing the curves for different coal prices. This results from the fact that the value of the fuel saving effected by the addition of base-load units is less with low-priced coal than with expensive coal.

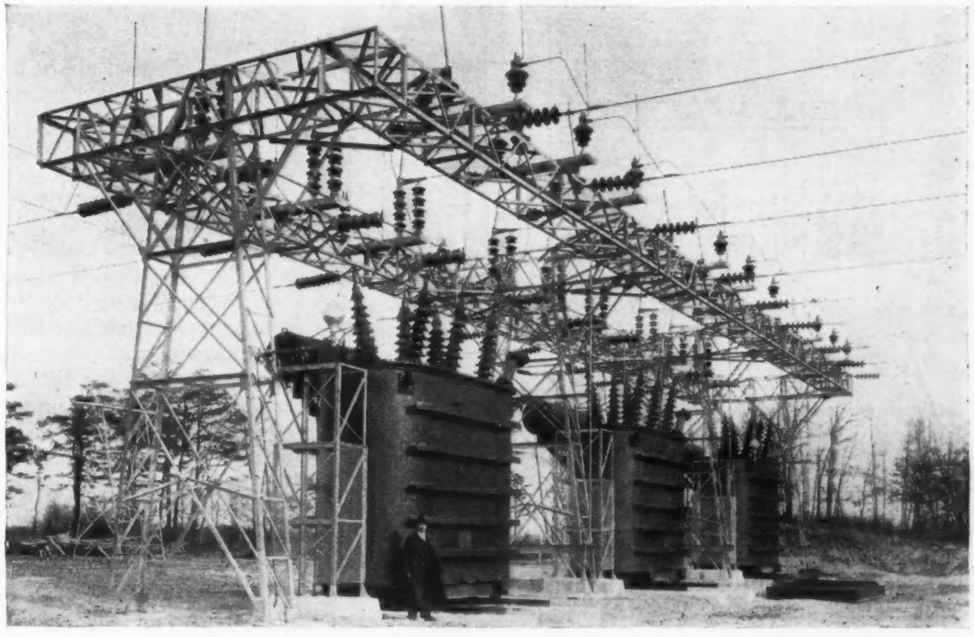
It is well to bear in mind in studying the figures presented in this paper that the results refer specifically to the assumed data. In conclusion, while these studies do not consider all possible cases of annual peak loads, they will direct attention to the importance of considering methods of carrying such peak loads and the possible place of steam accumulators and peak-load units in modern central stations. Each system is a problem in itself, and should be considered separately.

Auto-Transformers Tie Systems

Features of switching station that joins 110-kv. and 66-kv. systems and affords operating flexibility without complex design. Taps on high and low sides of transformers

By P. C. PRAY

Assistant Engineer New England Power Construction Company, Boston, Mass.

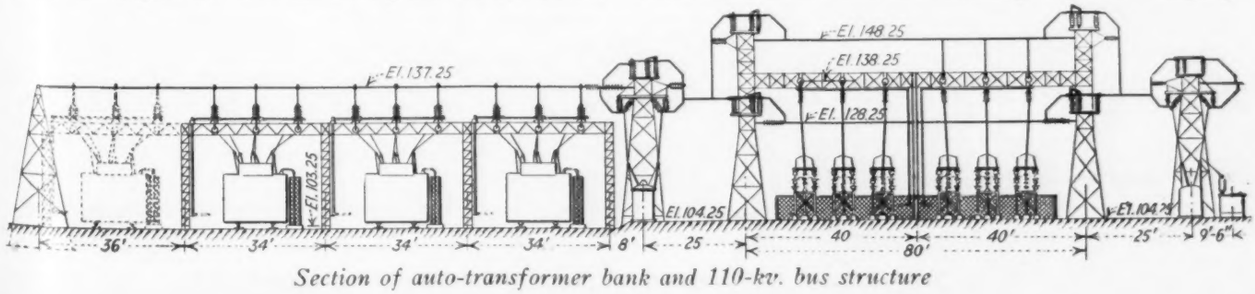


110/66 kv. auto-transformer tie

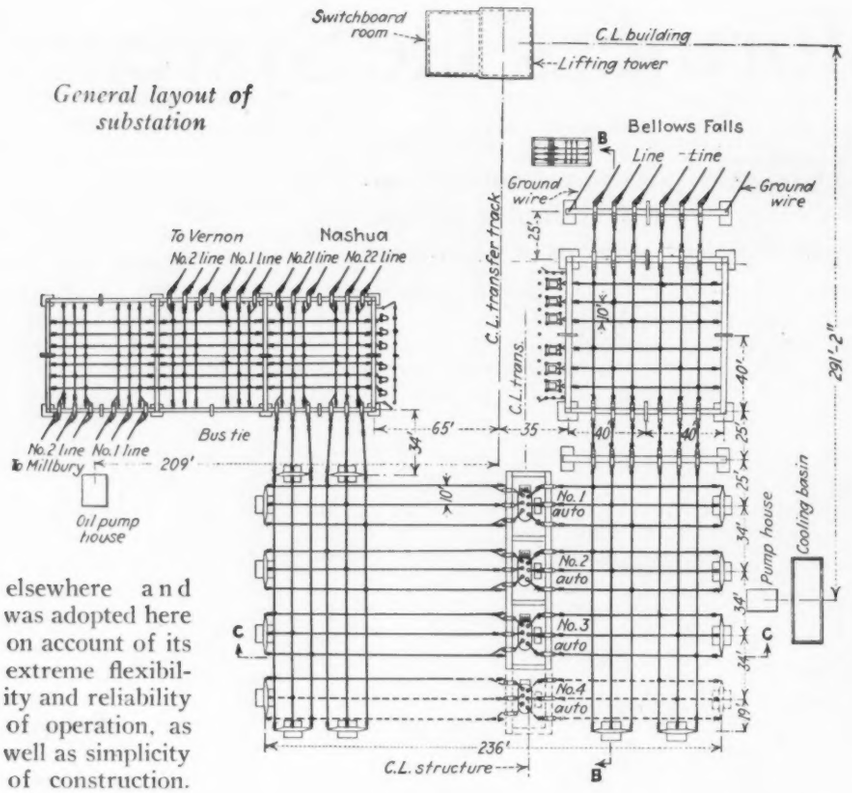
TO PROVIDE capacity for growth in the eastern part of the New England Power Company system an important sub and switching station has been built at Pratts Junction, Mass., tying the 110-kv. transmission circuits from the new hydro-electric development at Bellows Falls, Vt., into the company's high-voltage network north of Worcester and providing for future expansion of facilities from this point toward the load centers on the south and east. Auto-transformers aggregating 51,000 kva. are installed here to interconnect the 110- and 66-kv. lines and the engineering design of the substation features simplicity of layout and flexibility of operation.

The location fulfills the major conditions of proximity to the existing 66-kv. lines connecting the Vernon station of the company with the Worcester district, accessibility to a railroad by short siding and convenience to a main highway. Energy from Bellows Falls is received over two No. 4/0 circuits, reduced to 66 kv. by three 17,000-kva. transformers and introduced to the older portion of the system through a 66-kv. bus, to which are tapped two incoming circuits from Vernon, two southbound circuits to Worcester and two outgoing circuits to Nashua, N. H.

The 110-kv. bus structure is of the double bus type with gang-operated disconnecting shunt switches around the oil circuit breakers. The present structure accommodates two incoming lines and two high-tension transformer circuit breakers. Space is available for eight more 110-kv. lines. The double bus scheme in this substation has been used to advantage by the company



Section of auto-transformer bank and 110-kv. bus structure



General layout of substation

elsewhere and was adopted here on account of its extreme flexibility and reliability of operation, as well as simplicity of construction.

Single bushing type potential transformers are used on the incoming lines for synchronizing and voltage indication. Bus lightning protection is provided by two type "SV" autovalve arresters. Future extension is provided for at one end of the structure.

Characteristics of 66-Kv. Bus

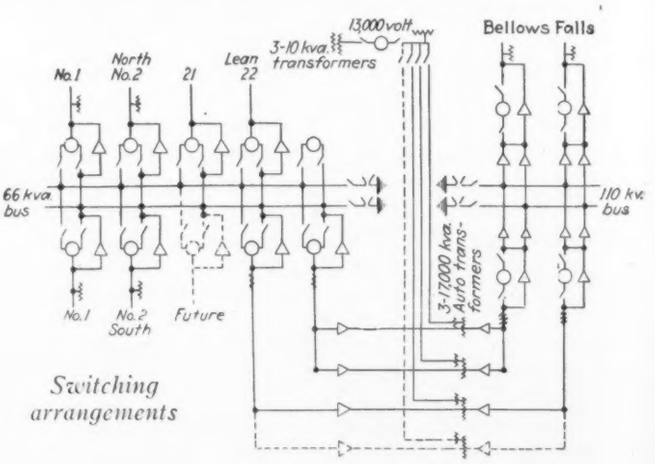
The wiring arrangement of the 66-kv. bus is similar to the 110-kv. bus except that the oil breaker can be shunted to only one bus instead of to either bus. Normal operation is to run on the bus not carrying the oil breaker shunts. When inspection occurs the bus tie oil breaker is closed, followed by closing the shunt upon its bus. This permits disconnecting the oil circuit breaker under consideration for maintenance and still provides the line with oil breaker protection. The bus tie oil breaker will be provided in the future on the 110-kv. yard. Bus lightning protection is provided as in the 110-kv. structure off one end of each bus, and bus sectionalizing switches of the gang-operated disconnect type are available in case of need. Six 66-kv. circuits, two transformer circuits and bus tie are now provided on the 66-kv. structure, which also has provision for future expansion.

Three 17,000-kva., three-phase, 60-cycle, water-cooled auto-transformers are now in service, with space for a fourth. Full capacity taps are available from 110 kv. to 95 kv. and from 69 kv. to 60 kv. in 5 per cent steps. A 7,500-kva. tertiary, delta-connected winding is used with three 5 per cent taps from 13.2 to 14.4 kv. No-load tap changers are provided in the 110-kv. and 14.4-kv. windings with handles brought through the cover and each set group-operated by a common shaft and handwheel.

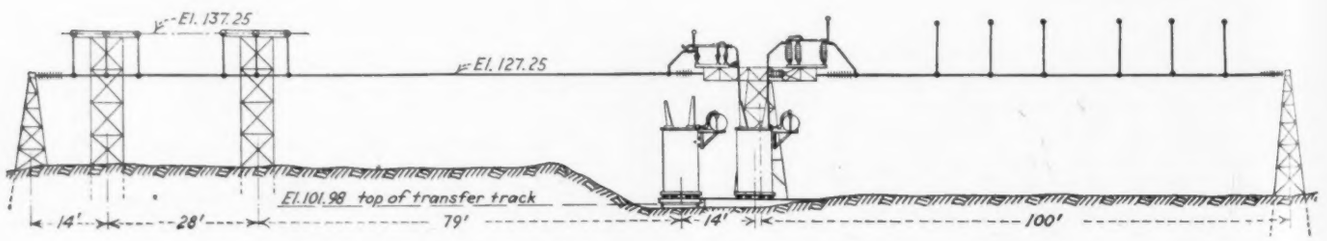
Sectionalizing air-break switches are installed to break the paralleling and magnetizing current and for killing each auto-transformer while changing taps. Water cooling is supplied from a cooling tower and pump system with make-up from a near-by brook.

All oil switches are of the solenoid-operated type and the control voltage is 250 volts d.c. Energy for operating the oil switches is supplied from a ring bus which circles the 66-kv. and 110-kv. yards, giving a double path for operating energy, as it is felt that the oil switch is no more dependable than the control wiring to it. In this case, cable trouble, if it occurs, can be sectionalized at any oil switch junction box and isolated with a minimum outage of equipment. This scheme is also very flexible when it becomes necessary to cut in additional equipment. Energy for operating the oil switches is derived from a 120-cell Electric Storage Battery Company's type EOGO-13 battery. The closed type of battery eliminates destructive gases and weeping due to charging and also the glass trays and sand (breeders of grounds) inherent with the open type battery.

The switchboard is of the usual double vertical type



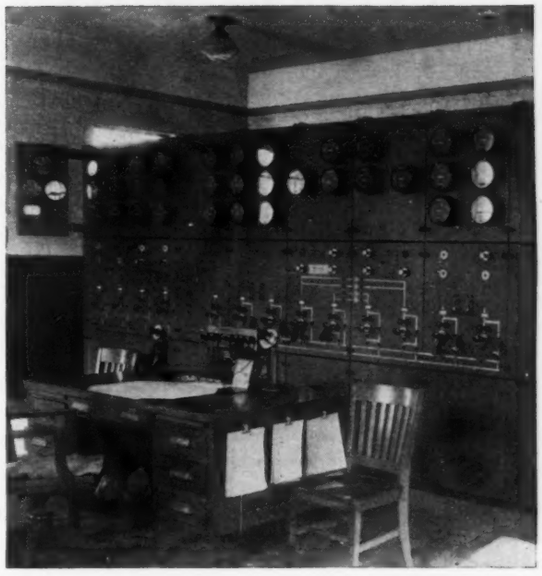
Switching arrangements



Section of 66-kv. and 110-kv. bus structures and intermediate auto-transformers

and is of black slate. The main board accommodates the oil switch control switches, ammeters on the various circuits, voltmeters, synchroscope connections and frequency meter; it also depicts in dummy bus the entire yard arrangement. Dummy disconnecting switches and telltale signal lights on the oil switches give the operator the condition of his yard at a glance. The auxiliary board is mounted behind the main board, but facing outward, with a grillwork closing in the ends of the boards. This board accommodates all of the relaying equipment. Cables are led from the outdoor manholes through a trench between the two boards to afford accessibility. All connections to the board wiring are made through terminal blocks.

The switchboard room is adjacent to the lifting tower part of the building. A 70-ton electric hoist is provided for handling equipment directly from the cars, which enter the building on a siding, or for untanking the transformers. A concrete pit is provided into which the whole transformer is lowered. The core and coils may be lifted out and raised to floor elevation. A false floor is placed over the pit on which the transformer core rests for repairs or overhauling. Storage space for spare parts and bushings and other electrical equipment is provided in the basement.



Switch control and meter board

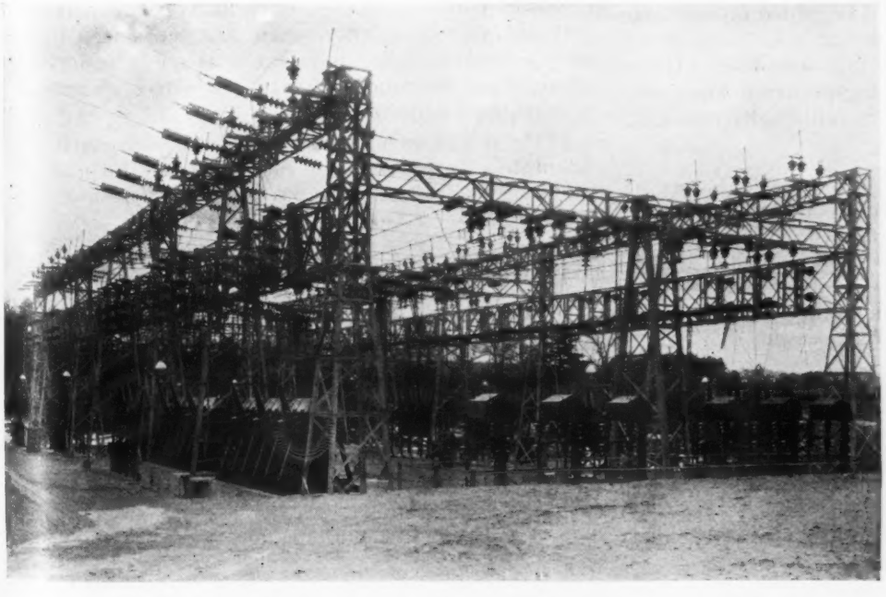
Substation Auxiliaries

At present the tertiary winding of the auto-transformers is used only on the station service which supplies energy for light and power for the cooling water pumps and oil filtering system.

Due to the size of the substation and the fact that nearly 50,000 gal. of oil has to be filtered annually, a central oil filtering plant was considered most economical. An 8,000-gal. tank and a 3,000-gal. tank were provided with necessary supply and return headers and branches running to each piece of oil-insulated equipment in the yard. These tanks are connected with a large filter press so that each tank can be individually filtered. It is also possible to pass oil in either direction from one tank to the other through the filter press or from either tank to the yard. The 8,000-gal. tank is capable of holding the contents of the largest piece of equipment in the yard, namely, the transformers. Satisfactory oil storage is expected as the oil tanks are placed above ground on concrete cradles to prevent condensation, and the inside of each tank is bakelited.

Good yard lighting is essential in outdoor substations. This is accomplished here by use of the Line Material Company's substation lighting unit, which consists essentially of one inverted street light with Holophane refractors modified for upright mounting 10 to 12 ft. above ground. Twenty-five 300-watt lamps are installed.

The major contract for materials on this job was with the Westinghouse Electric & Manufacturing Company, who furnished the oil switches, transformers and switchboard. The blade switching equipment was furnished by the Railway & Industrial Engineering Company and its type "TTR" high-pressure contact switch was used on both the 66-kv. and 110-kv. structures. Engineering and construction were by the New England Power Construction Company, Boston. On account of the contour of the land it proved more economical to put the 66-kv. bus structure on a lower bench. In construction, work was concentrated on the building and 66-kv. bus structure, benefits from the additional sectionalizing point on the Vernon lines being thus derived. The 66-kv. bus structure was put into operation as a sectionalizing substation eight months after starting work, and five months later the remainder of the yard was energized and built up to potential ready to operate at 110 kv.



66-kv. arbor from auto-transformers

36 Kw.-Hr. per Ton of Ice

MANUFACTURED ice at Boston requires from 27 to 45 kw.-hr. per ton, according to the load and time of year, and during 1929 ten new plants for its artificial production will be in service on the Boston Edison system. In a recent discussion J. W. Wattles of the sales department of the Edison Electric Illuminating Company of that city stated that the manufacture of ice has lately grown to important proportions in eastern Massachusetts owing to the increasing cost of labor for ice harvesting, mounting freight rates and the availability of cheap electric power for the manufacture of ice as required at the point of distribution. It is estimated that next year the ten new plants above referred to will produce about 700,000 tons, using electrical energy costing about $300,000, or about 40 cents per ton.

The Boston Ice Company has six large plants in operation in Boston ranging in capacity from 140 to 300 tons per day. Energy is purchased from the Edison company at 13,800 volts through a loop system of underground lines and is transformed to 460 volts for the operation of synchronous motors connected to the ammonia compressors. Two large plants are also in operation at Cambridge and others are in service at Milton and Roslindale. An ice-making plant with a capacity of 200 tons per day is being provided for the new Boston Madison Square Garden and it is equipped with three 200-hp. motor-driven compressors.

Commercial refrigeration is supplied at Boston on a rate of about 1.3 cents per kilowatt-hour for all consumption over the first 10,000 kw.-hr. per month, which is billed at 3 cents. If high-tension energy is used electricity in excess of 100,000 kw.-hr. per month is sold for 0.9 cent per kilowatt-hour. No demand charge is required, as this service is off-peak. Customers are notified of the hours of the peak load and if energy is used during these hours an extra charge of 4 cents per kilowatt-hour is applied to the consumption actually used during the specified hours.

Air-conditioning plants have lately been installed in one large store and four theaters. Each installation has two compressors driven by 175 or 200-hp. motors. During the summer the warm air is washed and cooled and then discharged at the top of the theater. About 60 per cent of the air is recirculated and 40 per cent taken fresh from outdoors. The temperature and humidity are automatically regulated by controlling the volume of fresh air taken in, together with the temperature of the air wash water. The cost of power last summer for conditioning each theater, purchased at the Edison company's refrigeration rate, varied from $2,000 to $3,700, a small item in comparison with the increased theater patronage obtained.

Some Essentials to Good Service

Public understanding, cordial relations and customer satisfaction at the lowest rates consistent with high financial credit

*Excerpts from Speech**

By Martin J. Insull
President Middle West Utilities Company

MOST troubles are due to misunderstanding or lack of understanding.

The electric service business is growing so rapidly that it is very difficult for the public to keep in touch with developments and the fundamental economics thereof.

Nothing is so important as a well-informed public, if questions which arise are to be settled on the basis of reason and not prejudice.

As the Bible says when Pharaoh died, "There arose up a new King over Egypt which knew not Joseph," therefore publicity is continually essential.

* * *

It is not sufficient merely to give good service at fair rates under cordial relations, because $50,000,000,000 of public money is invested in public service corporations, or one-seventh of the estimated wealth of the United States. The public should realize what stabilizes these businesses, so nothing will be done which will undermine the national wealth.

* * *

Capital is turned over in many businesses three to six times a year, whereas in the public service business it turns over only about once in five years or so.

Collectively, all public service corporations require about two and one-half billion dollars per year, of which one billion dollars is required by electric light and power companies.

With active favorable public opinion toward the public service business, no difficulty will be experienced in raising money to continue the development of service. But no one will invest in a business to which the public is antagonistic.

* * *

While public utilities are regulated monopolies, they are subject to very severe competition in the money market, unless their financial credit is high, which means their income must be attractive. This in turn requires reasonable rates.

If the public understands public utility economics, it will say, "Is this rate high enough so that the public utilities can secure money to render the service I require?"

* * *

With the tendency of the public to encroach upon business, there is a danger that it will kill the goose that lays the golden egg, whereas history shows that prosperity during the last eight or ten years has come from better business and consequently the higher wages and greater purchasing power produced.

* * *

It is far more important for the public to obtain service as needed and in adequate quantity and quality than it is to get a certain amount of service for the least money.

**Before Advertising Club of New York.*

Current Theories and Practice on

Valuation and Rate Base*

Author says recent speculative era has induced payment of excessive prices for utilities often passed on in rates

By F. I. SINGLETON

National Association of Railroad and Utilities Commissioners

UNDER normal conditions public utility rates depend upon the rate base. The rate base consists of the fair value of the utility property used and useful in serving the public at the time of the inquiry. The utility is entitled to a fair return upon that fair value. The basic question, therefore, in any rate case is the fair value of the property. At the risk of infringing somewhat upon the committee of valuation, the committee on public utility rates begs leave to discuss the rate base as an essential to the subject of rates.

The committee wishes fair value to be considered as a value that will be fair to the utility as a basis for return, and as fair to the utility's patrons as a basis upon which such patrons must pay the rates prescribed.

During recent years there has been a strong tendency for the owners of public utilities to insist that the fair value is the cost to reproduce new less actual depreciation, plus going concern value and working capital. This tendency has been stressed to such a degree that it has become alarming. It has been stressed in applications for securities issues as well as in rate cases. Unit costs have been loaded too heavily in an effort to furnish evidence of high value from which reduction may be made by the commissions and actual fair value remain for the return to the utility.

The historic cost of the property should be consulted in determining fair value. It is one check against wild estimates.

In many instances fair value of the utility property, as found by the commissions, has been entered upon the books in lieu of historic cost and the rate for depreciation reserve has been applied to the latter entry rather than to the cost to install. This has resulted in a greater amount of money being collected for depreciation reserve than the law and the methods of accounting contemplate. It is well known that the cost of installation is the basis for replacement, to be charged to the reserve for accrued depreciation.

Speculation in Utility Stocks

Since the World War and the prevalence of high prices brought about by it there has been a strong tendency to speculate in utility stocks, securities and utility properties. Commissions generally have been liberal in their scrutiny of evidences of value offered in such cases. Value found in one case cannot be excluded as evidence of value in any other case involving the same property. The amount of bonds and preferred stocks authorized in a security case must bind, to a greater or less degree, the commissions to grant rates sufficient to pay the dividends on securities so authorized. Rates must provide the money for such payments.

Schedules of rates and charges are not fixed for a day, but are intended to be for a period of years. Therefore, the trend of values at the time of inquiry, the trend of values for a reasonable period immediately preceding the time of inquiry and the prospect whether such trend of values will continue or will be varied during a period of years following the time of inquiry must be taken into account.

High Prices Paid for Utilities

During the period of speculation there has grown a willingness to pay almost any price for utility property. The reason for this has been that little difficulty has been experienced in securing an appraisal of the cost to reproduce new by some firms of independent engineers that would be equal to or in excess of any price that the purchaser might wish to pay. The result of all this has been for the speculator to buy utility property at any price, obtain authority to issue securities upon a value based upon estimated cost to reproduce new, etc., secure rates upon a valuation similarly high and thus pyramid the process at the expense of the patrons.

As a part of the process in establishing these extremely high values it has grown to be almost a custom to estimate going concern value as 10 per cent of the cost to reproduce new before depreciation.† The committee does not believe that going concern value has any legitimate connection with the cost to reproduce new. The cost to attach the business or the value of the business attached may be much greater or may be much less than 10 per cent of the estimated cost to reproduce new before depreciation.

The question of depreciation reserve has much to do with rates. This reserve is paid by the patrons as a part of their rates. It is intended to preserve the property in condition to render adequate service. However, the revenues so obtained, while accounted for in the book account of reserve for accrued depreciation, are largely invested in utility property used to pay for property upon which the utility collects a fair return. The patron pays for the property and pays a return on it. This causes the rate for depreciation reserve to be higher than it should in fairness be and causes the patron to pay more for the service than he should in fairness be required to pay. Such is not the intent of depreciation reserve; such is not fair to the patron.

The result of court decisions is to warn commissions to restrict with extreme care the rate for depreciation

**From the report of the committee on public utility rates.*

†Going concern value adds 10 per cent to physical reproduction cost.—EDITOR.

reserve and the value of the depreciable property. The intent is to prevent money paid by patrons for depreciation reserve being used in the construction of property as permanent or long-time investment upon which the utility receives a return.

Much attention has been given to the form of rate schedules. The committee regards this as not of the greatest consequence, though important.

What the service is worth to the patron is as important in a rate case as a fair return to the owner and operator of the property. If the rate be fair, it must be fair to both parties—the one rendering the service and the one paying for the service. If the utility property be over-built, the fault does not lie with the patron and, therefore, he should not be required to pay an excessive rate in order to provide a fair return. It is the duty of the utility to maintain an adequate service — adequate for the community in which service is rendered. It is obvious that more expensive construction and a higher grade of service will be required to render adequate telephone service in the city of New Orleans than will be required to render adequate service in a small village in a distant part of the state of Louisiana. The demands are not the same; therefore, adequate service can be attained at less investment and less operatig cost in other respects in the small village than in the large city. Commissions and utilities must recognize these conditions and suit their considerations and conclusions to them.

As members of regulatory bodies we soon learn that the rate factor in utility matters is like the high-voltage transmission lines—a messenger of peace and life more abundant and, at the same time, a messenger of death.

The doctrine of compensation has long been accepted as embodying a just and reasonable principle. Indeed, it has been extended beyond an application to material things and has entered into moral and spiritual spheres.

Rates seem to be responsible for many of the things that have disturbed and are disturbing the equilibrium between utility and utility and between utility and the public. This factor, more, perhaps, than any other, explains the existence of state commissions and boards of utility control. It explains largely the pronounced trend toward mergers and consolidations and the too-frequent inflation of sales prices as well as the attending requests for large security issues. While the public expects to pay a reasonable price for service required by it from the utilities, it quickly reacts against what seems to be an unjust or an exorbitant charge. The committee recognizes the justness of a customer charge, whether set out as such or not.

We cannot deny that the public believes utilities occupy a position of preference in our social structure. It is beginning to feel that rates, coupled with other advantages which utilities have under the law, are too high. Rates have a direct bearing upon public relations. This relationship reflects most generally the public interpretation of the fairness or unfairness of rates. Granting that the laws have wisely provided that utilities may demand a fair return on a fair value, we cannot miss this opportunity to emphasize the great value of proper and agreeable relations with the public, as suitable and necessary to be considered along with the adequacy and fairness of rate schedules.

We must not forget the philosophy contained in the Golden Rule. It has withstood successfully the most critical examination and trying experience. Large industrial concerns have operated very successfully upon the theory of the larger output and lower cost to consumer. Indeed, this has been generally accepted as the safest economic principle upon which to found a business. Certain utilities have recognized this principle and have adopted it as their policy. Other utilities seem to ignore it.

A rate should not be higher:

1. Than the grade or quality of the service rendered.
2. Than the service, though adequate, is reasonably worth to the patron.
3. Than the traffic will bear, comfortably.
4. Than will render a fair return as measured by return to the other business enterprises in the community served at time of inquiry.

Commissions should inquire into:

1. All evidence formally introduced in hearing.
2. The correctness of assumptions entering into unit costs.
3. The money cost of the property to its owners.
4. The matters of interest to the patrons, though not offered by them.
5. Whether the rates retard or discourage the extension of the service to a greater number of people, and why.

Commissions should not accept as final the evidence that is offered formally and make no further inquiry. Rates will continue to mount upward under such policy. A commission is not a court of record. It is a fact-finding body. Its duty is to seek the relevant facts and apply them with judgment. That judgment should be based upon absolute fairness to both the utility and the patrons and should encourage the best service.

Commissions are not on easy terms with either the public or the utilities. War prices have compelled increases in rates. Efforts to secure high appraisals have alarmed the public. Speculations in utility properties and utility securities have added to that alarm.

The committee holds that a proper regard for fair values and rates that are both adequate and fair is the best public policy and that the commission is the most trustworthy agency in securing such regard.

The most striking trend in rates during the past year has been the voluntary reduction of rates for gas and electric current. The very able report of Mr. Patterson of Alabama at our last annual session upon gas rates has

Commission Measures of Fair Value

1. Estimated cost of reproduction new less actual depreciation, plus going concern value and working capital.
2. Historic cost as shown by the utility's books.
3. Fair value as indicated by appraisal for purposes of taxation by the taxing authorities.
4. Price paid for utility property by its owners within a reasonable period of the time of inquiry.
5. Previous valuation of the utility property for any purpose, plus net additions and betterments, adjusted at time of inquiry to the trend of prices at such time and for a reasonable period immediately preceding.
6. The expected trend of prices for a reasonable period in the future.
7. The value to the patrons of service rendered and to be rendered.
8. The cost of rendering the service, plus reasonable return on fair value.
9. The amount of money taken from depreciation reserve and invested in the utility property

pointed in the right direction. The trend has been to follow the outline of the report. The result has been the further extension of the use of gas for house heating, refrigeration and manufacturing.

The Pennsylvania plan for extension of rural electric lines was discussed with interest and profit at our Dallas convention last year. This plan has formed the basis for a marked extension of electric service to rural communities. It has resulted also in the service being rendered on more equitable terms and at lesser rates. The committee believes that the regulatory bodies should encourage the use of the Pennsylvania plan and other similar plans, with such variations as found adaptable to communities served.

Voluntary reductions in rates, especially as applied to gas and electric service, have taken the form of optional rates. While the optional rate is designed, primarily, to avoid a rate hearing, it results in temporary relief. The optional rate usually has the effect to avoid reducing rates as much as should be, but it points the way and has some effect in the right direction. It gives opportunity for study to the end that equitable rates may be established with greater ease and accuracy.

Rate schedules should have greater flexibility. A rate schedule should be designed for adjustments automatically, if possible. A maximum rate, with provision that adjustment be made on the basis of legitimate operating costs, would avoid many expensive rate hearings and much bad feeling. Economic operation could and should receive greater reward in return than uneconomic operation. The frugal operator should be rewarded rather than penalized.

Utility's Auditorium Available as Public Meeting Room

AN AUDITORIUM in connection with a power company merchandising department which is available to the public can prove of great public relations value, particularly in some of the smaller cities where suitable meeting rooms may be scarce. An auditorium seating 200 in the basement under its merchandising department has proved its value in this respect as well as an important adjunct to the electric store of the Southern Colorado Power Company at Pueblo, Colo.

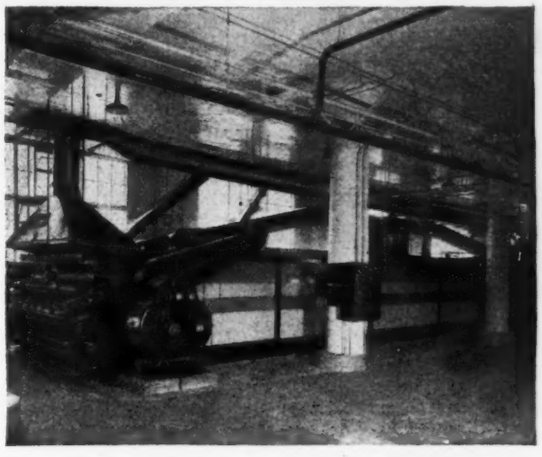
The use of this auditorium is offered free of charge on certain days of the week. The company reserves Tuesday and Wednesday of each week for its own use. On any other day, during business hours, organizations can obtain free use, including the model kitchen, by making reservations in advance. In the course of a year thousands of Pueblo people, largely women, attend meetings in the auditorium. The fact that the power company donates the hall is known to those present and proves a continuous instrument for better and more friendly understanding between the public and the company.

Each Wednesday the company holds a cooking class in the auditorium. On these occasions the equipment of a model kitchen is placed on the platform at one end of the room. Many of the women who have attended meetings in the auditorium come to the cooking schools through familiarity with the premises acquired at their organization affairs.

E. F. Stone, assistant general manager, is enthusiastic over the results obtained and feels that it is the best public relations and merchandising idea the company has ever introduced.

Electric Baking Found Best by Chain Stores

ALL BREAD and pastry sold through the 200 Oakland and other East Bay stores of Mutual Stores Inc., is now baked electrically. Recently a traveling type bread-baking oven was added to the existing instal-



Conveyor type bread-baking oven in plant of Mutual Stores, Inc., Oakland, Calif.

The oven is 60 ft. long by 9 ft. wide, has a connected load of 330 kw. and produces approximately 75,000 loaves of bread per day. Energy consumption is 97 kw.-hr. per 1,000 lb. of bread baked.

lation of four-deck type pastry ovens. The bread oven is in five sections, 60 ft. long and 9 ft. wide, having a balanced, three-phase, 220-volt connected load of 330 kw. It was built by Baker-Perkins Company, Inc., and is equipped with General Electric heating elements and automatic temperature control.

Sixty heaters of the B-P open grid type employing a "nichrome" ribbon are used. These are divided into five groups, two sections above the conveyor and three below. Terminals of the heaters and busbar connections are all inside the oven so that only two wires per phase need be brought out, thus reducing radiation losses. Opposite the end of each heater there is a well-insulated door, permitting inspection and replacement of heaters when necessary. The rate of travel of the conveyor is adjustable and provision is made for introducing steam under 5-lb. pressure for "bottom" bread.

The oven operates 24 hours per day except Sunday, turning out family white, Pullman, French, milk, cracked

Public appeal of electrically baked bread was important factor leading to discard of oil-fired ovens

Cleanliness and better working conditions resulted from this electric oven installation

The illustration shows the input end of a large conveyor type oven, the monorail system used in conjunction to reduce handling charges and the central control panel where head baker may check oven conditions.

Bakery Manager Says:

"When the over-all cost is considered and the following advantages of the electric oven are taken into account the company feels well justified in changing over to electric heat:

1. More thorough and even baking.
2. Crisp, brown crusts.
3. Finer texture.
4. Bread does not crumble and stays fresh longer.
5. Easier control of heat.
6. Flexible temperature control gives right heat for different kinds of bread.
7. Excludes possibility of explosion.
8. Cleanliness (no fumes).
9. Better working conditions.
10. Public appeal."

wheat, raisin, rye, pumpernickel, graham and whole wheat breads and buns. The maximum rate of production depends upon the product baked and varies from 3,000 lb. to 3,600 lb. per hour, or approximately 75,000 loaves of bread per day.

A complete test was made shortly after the oven was placed in operation May 1, 1928, and showed the consumption at that time to be 97 kw.-hr. per 1,000 lb. of bread baked. However, subsequent higher economy was expected after the oven became thoroughly dry and the sequence of operation had been more efficiently worked out. Because of a large motor load at the plant the exact rate applicable to the oven is not known, but the approximate rate earned is 1 cent per kilowatt-hour. This makes baking costs, on a fuel basis only, 97 cents per 1,000 lb. of bread baked for electricity, as compared with 60 to 70 cents per 1,000 lb. with oil-fired ovens displaced.

A 30-day test on the entire baking plant revealed the following data: Total load, light, power and baking, 252,000 kw.-hr.; maximum demand, 604.8 kw.; load factor for entire plant, 58 per cent; total consumption for five ovens, 158,700 kw.-hr.; consumption of bread-making oven, 135,600 kw.-hr.; pounds of bread baked, 1,399,855; kilowatt-hours per 1,000 lb. of bread baked, 97; cost per 1,000 lb. of bread baked at 1 cent per kilowatt-hour, $0.97; total consumption for four deck-type ovens, 23,100 kw.-hr.; total pieces of pastry baked, 489,456.

Increased Illumination Pays for Additional Foot-Candles

By M. Luckiesh

Director Research Laboratory, National Lamp Works, Cleveland

FACTORY tests, under levels of illumination up to 20 or 25 foot-candles, indicate that an increase in production results from an increase in the level of illumination. Laboratory researches, likewise, show that certain visual factors, upon which production depends, continue to increase far beyond the levels of illumination used in factory tests. We have extended the range beyond the region of 100 foot-candles for a background of 80 per cent reflection-factor or beyond the region of 1,000 foot-candles for a background of 8 per cent reflection-factor.

Factory tests also show that the value of the increase in production resulting from a moderate increase in level of illumination equals an appreciable part of the payroll. This net saving from increased production could be used to buy a further increase in illumination and it is surprising to note the magnitude of the increases in illumination that it will pay for.

Based upon actual investigation of the influence of the level of illumination upon production, we obtain the results tabulated below. Startling as these data may seem, if we began at 2 foot-candles or less, which is often found in industries, instead of at 6 foot-candles, the increases in production would be far greater for the same percentage change in the level of illumination. In this case the lighting system and number of workers remain constant, but the level of illumination and wage-scale are changed:

Per Cent Increase in Production	Actual Foot-Candles	Foot-Candles That Can Be Purchased by Increase in Production if Wages per Hour Are			
		30 Cents	45 Cents	60 Cents	90 Cents
0	6.0	...	...	...	...
2	9.4	17	25	33	50
4	13.0	33	50	67	100
6	16.6	50	75	100	150
8	20.0	67	100	133	200

For example, in the case of a wage scale of 46 cents per hour, where the level of illumination was increased from 6 to 20 foot-candles, an 8 per cent increase in production resulted. If this saving were spent for more illumination, it would buy an additional 100 foot-candles. By adding these 100 foot-candles to the 20 foot-candles, a further increase in production would result, and if this saving were used to buy additional foot-candles, a further increase in production would result. At some point the law of diminishing returns would indicate that further increase is uneconomical. This point differs for various industrial operations and conditions. We know little about it at present excepting, perhaps, that we are far from it in most lighting installations.

Letters from Our Readers

Cost of Power Stations

To the Editor of the ELECTRICAL WORLD:

I was very much interested and impressed by the article on "Power Costs in Large Plants" published in the Oct. 27, 1928, issue of the ELECTRICAL WORLD. I suppose that I was particularly pleased as it is a subject upon which I have been hammering for the last four years or so, which is the designing of steam plants of such an efficiency as to produce the minimum kilowatt-hour cost (including fixed charges and all other charges) at the switchboard.

My thought has been that many plants were designed against too high an efficiency and, after a rather thorough investigation by our organization here, found it to be so. During the last few years we have designed and built six steam plants that have been designed on this basis of minimum kilowatt-hour cost including all charges, and I thought you might be interested in the results:

Plant	Kilowatt Capacity All Plants on Same Basis	B.t.u. per Kilowatt-Hour D. S. Design	Capacity Factor	Cost per Installed Kilowatt
A	20,000	16,100	0.50	$84.18
B	20,000	18,100	0.40	73.83
C	108,500	16,200	0.50	89.10
D	46,400	17,400	0.59	88.40
E	20,000	17,500	0.338	86.60
F	20,000	16,500	0.416	87.26

NOTE—Kilowatt capacity includes house generators in all cases and is actual kilowatt capacity (name plate) at 0.80 power factor. All costs include substation up to high-tension side of transformers to outgoing transmission lines.

From the above you will see that they are rather consistent in cost per installed kilowatt even though they are located in four Middle Western states, so the coal cost had some effect upon the efficiency designed for. All of them that are in operation have bettered somewhat the efficiency against which they were designed. The main point that I had in mind for calling to your attention was that plants of smaller capacity, such as these are, have been designed to produce results definitely better than some of the larger plants, which of course should show lower construction cost per kilowatt, also lower cost per kilowatt-hour at the switchboard.

Your article must have accomplished much in clearing the air and toward eliminating so much inconsistency in the design of steam power plants.

WM. W. TEFFT,
Vice-President and Chief Engineer.
Commonwealth Power Corporation of Michigan,
Jackson, Mich.

"Heat Flow from Underground Cables"

To the Editor of the ELECTRICAL WORLD:

In a useful paper contributed to the American Institute of Electrical Engineers Neil P. Bailey apparently makes an assumption which is not warranted. On page 818 (November, 1928) of the *Journal* of the Institute of Electrical Engineers (line five from bottom right-hand column) he says, " . . . the duct surface will be approximately an equi-temperature surface," and he bases certain equations on this.

I think he can hardly be aware of the existence of the tests given, in diagram form, on page 191 of part No. 298 of Vol. 59 (February, 1921) *Proceedings* Institute of Electrical Engineers (London), which deal with this very question, and establish a temperature of 34 deg. C. at the bottom of the duct and of only 14.5 deg. C. at the top.

Possibly Mr. Bailey is considering a duct which is more nearly equal to the diameter of the cable. Nevertheless the assumption of an equi-temperature surface is one that seems to call for a certain amount of correction.

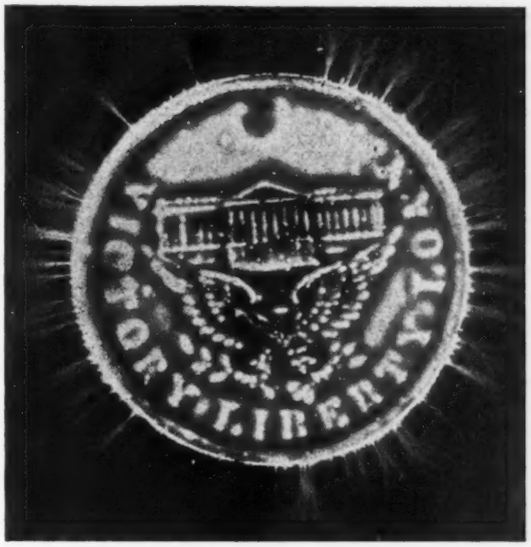
A. M. TAYLOR.
Slade Lodge,
Erdington, Birmingham, England.

A Forerunner of Photographic Analysis of Electrical Discharge?

To the Editor of the ELECTRICAL WORLD:

Voltage and over-voltage records or measurements with the aid of the recently perfected klydonograph are now a common occurrence.

Extensive research work has shown that photographic records of so-called Lichtenberg figures can be interpreted and calibrated to indicate nature, polarity, duration and potential with a surprising accuracy. Automatically operating recorders of this type with a plurality of electrodes and a roll film supply, lasting for several days, are in use on a number of important transmission systems.



Aluminum medal "photographed" by electricity

In connection with the above, it may perhaps be of some interest to recall some investigations made by the author early in 1914 and published in *Elektrotechnik und Maschinenbau* (Vienna, Austria), Vol. 28, 1914, and in ELECTRICAL WORLD, Sept. 5, 1914, page 485. Fifteen years ago I found by mere accident that if a condenser is formed with a plain metal plate as one electrode, a photographic glass plate as dielectric and a coin as the other electrode, and if a direct or alternating potential or about 5,000 volts is applied for a fraction of a second to this condenser, a fairly good negative of the coin will be found upon development of the photographic plate. No attempt was made at that time to explain the peculiar phenomenon; it was merely suggested to use this method of photographing metal relief designs. The accompanying illustration shows an example of such a corona-photo made recently of an aluminum medal.

A. PALME.
Pittsfield, Mass.

Digest of Electrical Literature

Generation, Control, Switching and Protection

Switching Phenomena in Preventive Auto-Transformers. — K. TOFFLINGER. —On transformers with voltage taps so arranged as to permit their change under sustained load, so-called load-ratio-control, it is sometimes customary to use a preventive auto-transformer as an auxiliary to either prevent shorting individual transformer taps during the changing cycle or to obtain more operating voltages than there are taps on the winding. In either case hitherto little known switching phenomena occur during the transition period, which may give rise to dangerous over-currents and over-voltages due to the double remagnetization of the auto-transformer. The over-current may weld or damage the contactors, while the excess voltage, reaching in some designs five or ten times normal, may cause flashovers. The author has investigated this problem and suggests as a partial remedy ohmic resistors temporarily in series or in parallel with the tap reactor, or connections to it in loop form, to take advantage of mutual inductive damping action. It seems, however, that no fully satisfactory and economic method is known to avoid these disturbances, and that the only positive remedy is to design reactor, contactors, connections and the transformer itself in such a way as to be safe against the highest values of current and voltage, which may be expected from any specific design.—*Elektrotechnische Zeitschrift,* Nov. 8, 1928.

Calculation of Commutating Pole Air Gaps.—H. BECHMANN.—Commutating poles on direct-current generators and rotaries are designed frequently with a double air gap, one toward the armature and one toward the yoke, to reduce magnetic stray flux. The exact calculation of such compound gaps is rather involved. The writer develops an empirical approximation formula which has proved to come within 10 per cent of the correct value. — *Elektrotechnische Zeitschrift,* Nov. 1, 1928.

Transmission, Substations and Distribution

Heat Flow From Underground Electric Power Cables.—NEIL P. BAILEY.—The heat resistance of the soil surrounding underground cable ducts is usually large and the path of the heat through the soil is not simple, especially when there are several adjacent ducts. This heat resistance and the path of the heat flow may be determined graphically, but in the simpler cases this method becomes difficult. Heat resistance of any of one of several ducts can be calculated theoretically by making assumptions of unknown magnitudes. To check these calculations by testing actual installations would be slow and expensive. Advantage may be taken of the similarity between the flow of heat and the flow of electricity to set up and test electrical equivalent of any duct system. In this way the theoretical results can be checked readily with a minimum outlay of equipment. The results obtained by this method are described by the author and indicate that the theoretical calculation may be accurate even for close spacing and also to represent the actual path of the heat in a group of several ducts. Thus the heat resistance of a duct may be found quite accurately, if the specific heat resistance of the soil is known.—*Journal of the American Institute of Electrical Engineers,* November, 1928.

Quartz Bushings.—M. MELLET.—The excellent mechanical, chemical and electrical qualities of pure, fused quartz recommend its application to the design of high-voltage bushings. All previous attempts to adapt it to this use have failed, however, because the new material was misapplied in futile endeavors simply to replace porcelain, which resulted in large and therefore costly shells of quartz. Considering the relative values of dielectric strengths of air, oil and quartz (1:2.5:3.5), the author has developed a new type of dry and of oil-filled bushing, in which a simple cylindrical block of quartz provides the major insulation. The inside of the block is metallized by either a chemical deposit of silver or a zinc metal spray, with the layer of metal connected to the central conductor, thus distributing the field and preventing internal corona disturbances. Surrounding the quartz cylinder is an outer shell of porcelain, the space between the two is air-filled for low-voltage dry bushings, or oil-filled for the high-voltage type. This construction permits relatively very small shells of quartz to be used for bushings of up to 600-kv. test voltage. Under oil a creepage length of one centimeter along quartz for every 10 kv. is claimed to be safely permissible.—*Revue Générale de l'Electricité,* Nov. 3, 1928.

Cement Posts.—T. PANSERT.—Transmission line poles made of reinforced concrete by the centrifugal method have, aside from their neat appearance, a number of advantages over wooden posts or fabricated steel towers. The present article covers a simple mathematical method of calculating dimensions and strength of such poles, describes the machinery of making them and goes into some detail on the shipping and erection. Little has hitherto been published about the rotating mold and the manufacturing process itself. The author shows such a mold for poles of 82 ft. length, driven by a 75-hp. motor at a speed of 600 r.p.m.. A suitable steel skeleton is placed in the mold, and after charging with cement a rotating period of fifteen minutes is sufficient to set the cement, allowing removal of the mold with the pole from the spinning machine. After twelve hours the mold can be removed and the pole is placed for twelve days in wet sand. Railroad shipment is then readily and safely permissible.—*Revue Générale de l'Electricite,* Oct. 13, 1928.

Hydro-Electric Development and Steam Equipment

Burning Brown Coal at the Yallourn Power Station.—The coal used in the power station described in this article varies between 50 and 64 per cent moisture and presents a number of difficulties which have strongly influenced the design and operation of this plant. Test results indicate that with a satisfactory efficiency the grates are capable of burning over 60 lb. of raw coal per square foot per hour, corresponding to a heat liberation of 314,000 B.t.u. per square foot per hour, or to a maximum liberation of 417,500 B.t.u. per square foot of grate per hour. The coal is pre-dried by passing the hot flue gases from the boiler through it. Details of the design of this station as well as data regarding performance and operation have been included.—*Electrical Engineer (Australia),* Oct. 15, 1928.

Units, Measurements and Instruments

Integrating Peak Meter for Households with Accumulating Cookers.—A. WIDSTRÖM.—A special meter intended for use with household rates consisting of a fixed annual fee for a subscribed average amount of energy per quarter hour combined with a kilowatt-hour fee for additionally consumed energy has been devised. Such a rate is being applied in Stockholm for households where, in addition to electric lighting, accumulating cookers, water heaters or other apparatus accumulating energy are in use. The meter is so designed that, if the total demand consumed for lighting and by accumulating apparatus exceeds the demand limit, the accumulating apparatus is automatically disconnected, but remains so only until the average load reverts to the demand limit subscribed to. If the demand consumed for lighting only exceeds the demand subscribed to, the accumulating apparatus will automatically be kept disconnected, and the amount of energy consumed for lighting that exceeds the amount subscribed to will be registered by a separate calculating apparatus.—*Era,* Oct. 15, 1928.

High-Voltage, Direct-Current Cable-Testing Car.—H. MEHLHORN.—A description of high-voltage, direct-current cable-testing equipments of modern design, using vacuum tube rectifiers. The compact arrangement of all required apparatus for a 150-kv. testing set in an automobile trailer is of interest. A 20-kva. transformer with 60 kv. secondary, with voltage doubling condenser connection, permits an equipment of such high potential to be installed in a minimum of space. To locate faults in a cable, a high-voltage resistance bridge can be used as an accessory to the equipment. Full details are given on this specially designed bridge.—*Siemens Zeitschrift,* October, 1928.

Illumination

The Transmission of Light Through Liquids.—SAMUEL G. HIBBEN.—Laboratory experiments and field data have been correlated in this examination of knowledge regarding the properties of various liquid media in transmitting and diffracting light. The author has described check tests on transmission through water, adding measurements of more practical nature that cover the shape and color discrimination of objects seen when submerged. The data indicate the deviation from the inverse square law and the author discusses the factors influencing visibility, particularly the conditions under which maximum visibility of submerged objects can be obtained.—*Transactions of the Illuminating Engineering Society,* October, 1928.

Heat Applications and Material Handling

Coal Dust Precipitation. — Electrostatic precipitation of mineral dust, known as the Cottrell process, has long been used successfully, but doubts regarding its applicability for precipitating combustible dust, such as, for example, coal dust in collieries and briquet presses, has been expressed. It was assumed that a possible flash-over from charged to grounded electrodes might set fire to the coal dust. Improvements made on vertically arranged filters and experiences gathered on about 250 installations dispelled all prejudices of this nature. The article gives much valuable information on the safe design of such filters, particularly adapted to briquet pressing plants, where the precipitation is not only employed to guard the neighborhood against the dust nuisance, but where the collected dust represents itself a very considerable value. Filters installed in 242 such plants collect annually some 350,000 tons of coal dust! Operating with mechanically rectified direct current of 30 to 40 kv., an energy consumption of 5/100 kw.-hr. is required for every 35,000 cu.ft. of dust-laden air. A bypass chimney is recommended to permit cleaning of the precipitator without interruption of production. A properly kept equipment is not expected to flash over with less than 58 kv. or about 45 per cent overvoltage.—*Siemens Zeitschrift,* October, 1928.

Cement Grinding Mills.—R. H. WILMOT.—A general description of ball and tube grinding mills together with a consideration of their starting and running characteristics, power requirements and empirical formulas. Practices regarding type of driving motor and arrangement of drive are described and recommendations made in connection with methods to be developed. The importance of the grinding process in the production of cement is emphasized and the superiority of electric drive for grinding purposes pointed out. The author has reduced the discussion to a rational basis by classifying the requirements of the several drives and has introduced mathematical discussions for the clarification of the subject. It is concluded that the drive of each particular grinding mill should be considered upon its own merits and the decision made upon the information available and based upon the general previous experience of the electrical or mechanical engineer concerned. It is contended that the cheapest and best drive is a slip-ring motor driving the grinding mill through a double helical reduction gear unit. — *World Power (England),* November, 1928.

Motors and Control

Thermal Cut-Out Switch. — A. COUTEAUD.—A low-voltage, low-output switch is described which is fitted with a trip mechanism, actuated indirectly by a thermostatic metal strip. The opening of the switch is brought about by a rather involved action, in that first a hot-wire expands and establishes the path of current across the bimetallic strip, the deformation of which closes in turn a magnetic trip solenoid, which accomplishes the actual opening. By this method, the author claims, a wide range of adjustment is made possible both as to current and to time. For example, a 5-amp. switch will trip in 43 seconds with a load of 6.25 amp., in fifteen seconds with 8 amp., in four seconds with 10 amp. and in 1/100 second with 400 amp.—*Revue Générale de l'Electricité,* Oct. 20, 1928.

Traction

Non-Destructive Detection of Flaws.—ELMER A. SPERRY.—A description of the procedures and equipment used in detecting the hidden fissures in rails without in any way impairing the service characteristics of the material. The rails may be tested while in service, as this procedure involved only the contact of the several brushes with the rail surface while they are drawn along the track. It is stated that positive indication is afforded not only of the exact location of the fissure but also of its size. The uniformity of the potential drop which exists at all other points of the rail is interrupted at a fissure. Although the disturbance is minute through the amplification provisions of the equipment it is brought up to visible magnitude to operate indicators or recorders or similar devices. The rails may also be tested at the mill previous to shipment. In this apparatus a main primary energizing current is made to traverse the rail or a section thereof by means of main brushes in contact with the track. Intermediate between these brushes are circuit brushes which are connected to two opposite primary poles constituting the primary of a transformer. These coils are oppositely wound and produce opposite magnetic excitation of the transformer. All variations in the primary current will be picked up by the two other brushes and thus be completely neutralized as to their influence upon the secondary.—*Iron Age,* Nov. 15, 1928.

Miscellaneous

Steel for Case-Hardening (Normal and Abnormal Steel).—S. EPSTEIN and H. S. RAWDON.—That soft spots in case-hardened articles may be due to the kind of steel used has been experimentally confirmed by the authors. The characteristics of the so-called normal and abnormal microstructures of the extreme types and intermediate gradations are described. It was found that upon quenching in water structurally abnormal steel proved more prone to give soft spots than normal steel. But that by quenching in brine or other drastic quenching media uniformly hard cases were obtained in structurally abnormal steel as well as in normal steel. Most cases of abnormality in commercial steel seem to be associated with the use of aluminum for deoxidizing, although abnormal steel can also be produced in other ways. Nothing is said to have arisen during the progress of this investigation to disprove Ehn's theory that abnormality is ordinarily chiefly due to the presence of oxides perhaps dissolved but more probably undissolved.—*Research Paper No. 14, Bureau of Standards.*

The Thermal Expansion of Fireclay Bricks. — ALBERT E. R. WESTMAN. — Samples of twenty brands of fireclay bricks which included a rather wide range of physical and chemical properties were obtained from various manufacturers. The thermal expansion behavior of these bricks in the temperature range 25 deg. C. to 950 deg. C. was determined by means of apparatus developed for the purpose. Information concerning the mineralogic composition was obtained by petrographic methods and from chemical analyses submitted by the manufacturers. Thermal expansion curves as obtained were classified on the basis of the presence or absence of certain characteristic inflections in the curves. The customary explanation for these inflections, namely, that they were due to the inversion of cristobalite and quartz present in the bricks, was subjected to a quantitative test by calculations based on the curves, the petrographic data, and the chemical analyses.—*University of Illinois Bulletin,* Vol. XXVI, No. 1.

News of the Industry

Harold B. Smith for Head of Institute

Nominating Committee of A.I.E.E. Selects Worcester Polytechnic Professor of Electrical Engineering for President — Other Official Nominations

NOMINATION for president of the American Institute of Electrical Engineers for the year beginning Aug. 1, 1929, of Harold B. Smith, professor of electrical engineering at the Worcester Polytechnic Institute, Worcester, Mass., was announced on Tuesday by the national nominating committee of the Institute, choice by which is equivalent to election. Professor Smith will succeed Rudolph F. Schuchardt, the incumbent of the office. A biographical note on the coming president, with his portrait, is printed under "News About Men of the Industry" on page 1218.

The other official nominations are:

For Vice-Presidents:

Middle Eastern District—E. C. Stone, system development manager Duquesne Light Company, Pittsburgh.

Southern District—W. S. Rodman, professor of electrical engineering, University of Virginia, Charlottesville, Va.

North Central District—Herbert S. Evans, dean College of Engineering, University of Colorado, Boulder, Colo.

Pacific District—C. E. Fleager, assistant vice-president Pacific Telephone & Telegraph Company, San Francisco.

Canadian District—C. E. Sisson, transformer engineer, Canadian General Electric Company, Toronto.

For Directors (formerly Managers):

J. E. Kearns, electrical engineer, General Electric Company, Chicago.

William S. Lee, vice-president and chief engineer Duke Power Company, Charlotte, N. C.

Charles E. Stephens, district manager Westinghouse Electric & Manufacturing Company, New York.

For Treasurer:

George A. Hamilton, electrical engineer (retired), Elizabeth, N. J.

These official candidates, together with any independent nominees that may be proposed later in the manner specified by the constitution and bylaws, will be voted upon by the membership at the coming election in the spring of 1929.

Wisconsin Public Service's New Rate Schedule

Hearing on the petition of the Wisconsin Public Service Corporation for permission to revise its residential electric lighting rates in 101 communities in northeastern Wisconsin, introducing a room charge, was held before the Railroad Commission of Wisconsin at Madison on Dec. 4.

Consumers who live in homes of five rooms or less and use 20 kw.-hr. or less a month will have no change in their bills. Those who occupy homes of more than five rooms and use in excess of 40 kw.-hr. a month will have an increase of half a cent per kilowatt-hour for all energy used in excess of the first 40 kw.-hr. up to 80 kw.-hr. Above 80 kw. there is a reduction of 3½ cents. The price of the first 40 kw.-hr. is to remain the same and those not exceeding that amount will have neither a decrease nor increase in their bills. The principal benefit of the change will be reaped by those who live in homes of five rooms or less and use in excess of 20 kw.-hr. a month.

The rate for Green Bay, headquarters of the Wisconsin Public Service Corporation, and surrounding towns is as follows: First 4 kw.-hr. per room per month, 10 cents gross per kilowatt-hour; next 4 kw.-hr., 7 cents gross; excess, 3 cents. The blocks at 10 cents and 7 cents gross shall not be less than 20 kw.-hr. nor more than 40 kw.-hr. per month. In other communities the principle proposed is the same, though the charge for the first two steps may be higher, depending upon the distance from production centers.

The present home-lighting rate is: First 40 kw.-hr. per month, 10 cents; next 160 kw.-hr., 6½ cents.

Boulder Dam Bill Slated to Get Through

Compromise Reached by Which California and Arizona Split the Water in Dispute—Unanimous Consent to Limit Debate May Insure Passage Before Recess

By Paul Wooton
Washington Correspondent for the Electrical World

PASSAGE of the Boulder Dam bill before the holiday recess apparently was assured on Wednesday, Dec. 12, when the Senate entered into a unanimous-consent agreement to limit debate on this measure. As there are only ten senators who are likely to want to discuss the amendments, the fifteen-minute rule agreed to will mean that the amendments can be disposed of promptly. Before passage it is anticipated that numerous amendments will be attached to the bill.

By a vote of 48 to 29, an amendment by Senator Bratton of New Mexico was adopted fixing 4,400,000 acre-feet, instead of 4,600,000, as the amount of water to be received by California and fixing Arizona's share at 2,800,000 acre-feet instead of 2,600,000 as in the original bill. Arizona had insisted that California be limited to 4,200,000 acre-feet. Nevada's share remains at 300,000 acre-feet, thus making up the 7,500,000 acre-feet allotted to the three lower-basin states. This is the result of a compromise between Arizona and California. Other compromises and "trades" are in the making. An effort by Senator Hayden of Arizona to require ratification of the Colorado River compact by all seven states was voted down. An amendment allowing the Federal Power Commission to proceed with applications on the Gila River was approved.

Senator Johnson of California voted against the amendment giving California 4,400,000 acre-feet of water. This represents a concession of 200,000 sec.-ft. from the amount he had been claiming. He had agreed to that plan apparently with the understanding that the Arizona senators would support the other provisions of the bill. When he found that was not the case he voted against the amendment, but it was passed nevertheless.

The adoption of the unanimous-consent agreement means that there will be relatively little opportunity to discuss the important economic and engineering aspects of the project. To Senator Johnson credit is being given for skillful strategy in having confined general debate largely to the less important phases of the legislation.

Many difficulties will face the conference committee of the two houses. If the House will accept the provision of the Senate bill under which the Secretary of the Interior is allowed to use his discretion in the handling of the water power which may be developed it is believed that the President will sign the bill. In view of his message to Congress it is taken for granted that he would veto the bill in the form that it passed the House.

The Secretary of the Interior, under the provisions of the Senate bill, would attempt to lease the water to be used for power purposes. In the event that no offer were forthcoming he would then be authorized to construct the power plant. An effort then would be made to lease the plant to private enterprises. If that should fail, he then would be authorized to operate the power plant. One of the amendments to be offered is that the leasing of the water for power purposes shall be in

accordance with the provisions of the water-power act.

The decision to limit discussion in the Senate followed drawn-out debate, renewed almost daily, in which much old straw was thrashed again by the senators from the Colorado Basin states.

Farm Uses of Electricity

Rural Electrification Division of A.S.A.E. Meets in Chicago—Project Directors and Utility Men Compare Notes on Farm Applications

FARM wiring, motor installations, water systems, dairy refrigeration, feed grinding, ventilation and other problems of farm utilization of electricity were covered in an admirable series of papers presented to the Rural Electrification Section of the American Society of Agricultural Engineers at its midwinter meeting in Chicago, Dec. 6 and 7.

Farmstead wiring is an important phase of a growing industry, said H. S. Hinrichs, Kansas Power & Light Company, and one that will require a prompt and satisfactory solution. Mr. Hinrichs outlined the special conditions which attend distribution of electricity on the farmstead. That the manufacturers of wiring equipment have a job to do in the development of materials and fittings adapted to farm requirements was pointed out by H. H. Weber of the Rome Wire Company, while G. A. Reitz of the General Electric Company said that satisfaction with motor applications on the farm depends upon due consideration of five factors—selection of the proper machine for the work, the power supply, motor and control to fit the power requirements, location, and proper installation of the complete equipment. The first session was closed with an exhaustive paper on farm water systems by J. P. Schaenzer, Wisconsin.

E. R. Meacham of the Wisconsin Power & Light Company opened the afternoon session with a paper dealing with motor-driven feed grinders; W. T. Ackerman, New Hampshire project director, took up dairy refrigeration and applications of refrigeration to household uses, to fruit and truck farms, to poultry farms and to marketing and shipping organizations; Truman E. Hinton, Purdue University, in a companion paper, said that there are many retail dairymen who can reduce their costs of distribution and their losses from improperly cooled milk by the use of mechanical refrigeration; a description of seed testers now in use in the state was included in a paper by E. W. Lehman of the University of Illinois, and G. C. Briedert of the Ilg Electric Ventilating Company outlined an installation for ventilating and heating cow barns.

Round-table discussions on rural load building, utility merchandising, silo filling and grain and feed elevators filled the second day. In the afternoon the model farm of the Public Service Company of Northern Illinois was inspected under the guidance of Richard Boonstra, agricultural engineer of that company.

Edison Medal Awarded to Frank B. Jewett

Vice-President of American Telephone & Telegraph Company to Be Recipient of This Distinction from A.I.E.E. for 1928

ANNOUNCEMENT was made on Dec. 6 that the Edison medal has been awarded by the Edison medal committee of the American Institute of Electrical Engineers to Dr. Frank B. Jewett "for his contributions to the art of electrical communication."

Frank B. Jewett, vice-president American Telephone & Telegraph Company and president Bell Telephone Laboratories, Inc., was born at Pasadena, Calif., Sept. 5, 1879. He was graduated in 1898 from Throop Polytechnic Institute (now the California Institute of Technology). He then took up graduate work at the University of Chicago under Prof. A. A. Michelson, receiving

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F. B. Jewett

his doctor of philosophy degree in 1902. Later he was instructor in physics and electrical engineering at the Massachusetts Institute of Technology, and in 1904 he joined the staff of the American Telephone & Telegraph Company, taking charge of the engineering research work and thus beginning his record of brilliant attainments in the telephone field.

From 1908 to 1912 Dr. Jewett was transmission and protection engineer, and under the direction of John J. Carty, then chief engineer, he had responsibility for working out the methods which led to the introduction in telephone service of phantom loading, loading of large-gage and open-wire circuits, the practical use of telephone amplifiers and development of phantom duplex cables. In 1912 he became assistant chief engineer of the Western Electric Company, and in 1916 chief engineer, having charge of the research laboratories and all engineering in connection with Western Electric manufacturing. Six years later he became vice-president of the Western Electric Company. In 1925 he assumed his present offices with the Western Electric's allies.

Dr. Jewett is a fellow of the American Institute of Electrical Engineers, of which he was president during the year 1922-23.

New York Commission Seeks Uniform Rates

On recommendation of Chairman Prendergast, the New York Public Service Commission will hold a hearing at Albany on Jan. 15 concerning existing rates and charges for gas and electricity of all gas and electrical corporations serving the public, "to the end that the commission shall, if it deems proper, by order prescribe uniform forms of schedules and regulations for all such rates and charges throughout the State of New York."

At the New York hearing on Dec. 7 into the question of submetering (ELECTRICAL WORLD, Dec. 8, page 1163) the complainants rested their case and argument for the companies opposing the practice began. A thorough investigation, going beyond the mere question of legality, has been promised by Mr. Prendergast.

Rates in Puget Sound Territory Go Down

Reductions in residence and commercial lighting rates estimated to total more than $220,000 annually and affecting all customers of the Puget Sound Power & Light Company except those within the city limits of Seattle have been announced by President A. W. Leonard. The reductions range from ½ cent to 1 cent a kilowatt-hour in the primary rate, and in certain cases the secondary rate is also reduced. Establishment of a combined rate for electric cooking and lighting by which all electric service in the home and on the farm may be furnished through a single meter is also announced. The latter rate is based on a primary charge ranging from $1.25 to $1.75 a month plus 3 cents per kilowatt-hour for the first 150 kw.-hr. and 2 cents for all excess. The combined rate will become effective on Jan. 1 and the general rate reduction Feb. 1.

Fourth Section of St. Louis' Lighting System in Use

Started by Westinghouse sound-sensitive apparatus actuated, on signal, from a wind-driven siren on an airplane 2,000 ft. above the ground, the fourth, or downtown, section of the new street-lighting system in St. Louis was flashed into service on Monday night of this week. Mayor Miller was the leading spirit in a celebration which followed.

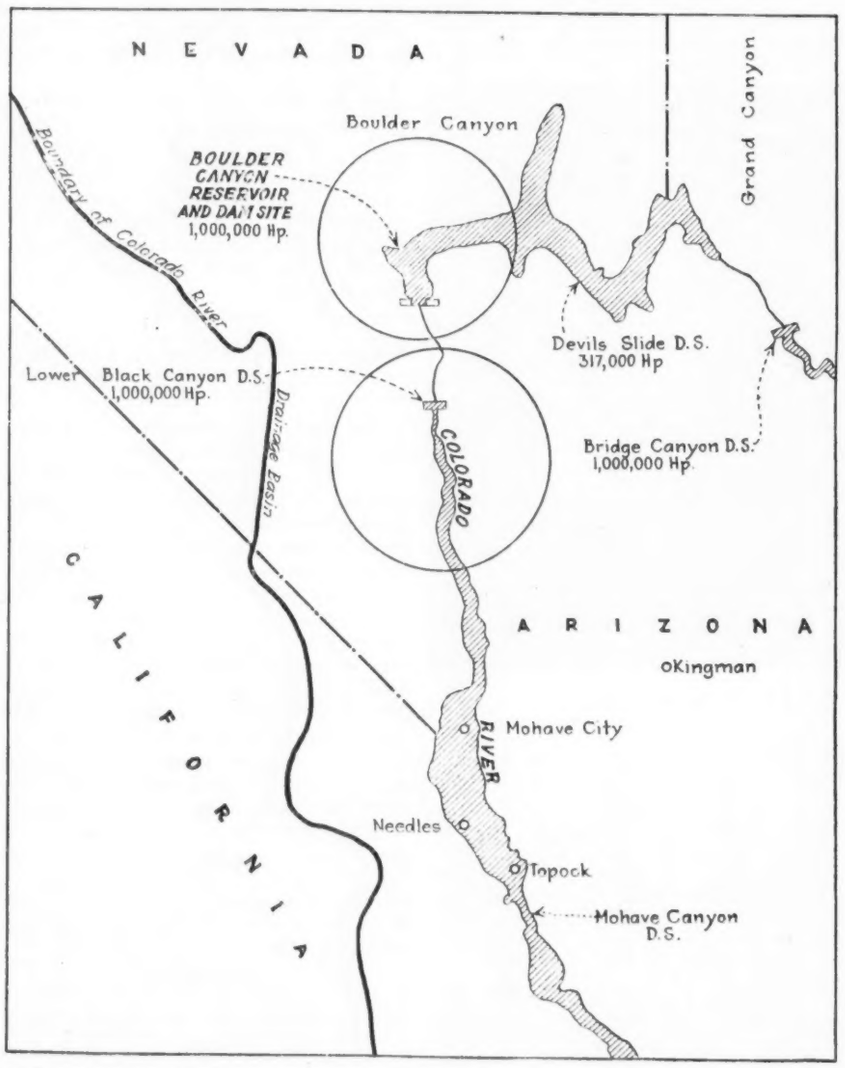
For the new installation the contract was awarded March 13 last. It

amounted to $2,235,985 and includes 752 large two-lamp standards, 774 large one-lamp standards, 1,456 intermediate standards and 1,392 residential standards. The four contracts, with the addition of special orders placed by the city, make a total of 25,758 standards thus far installed. They are of Westinghouse hollow-spun concrete. The first contract was let in 1925 to the amount of $1,230,000. It included 9,367 posts, 600 miles of cable, three substations, eight miles of primary feeders and other equipment. The second contract was let in the fall of 1926 and amounted to $558,000. It provided for 3,258 posts. In the spring of 1927 a third contract was awarded amounting to $803,400 and including 4,355 posts. St. Louis now claims one of the most brilliantly lighted metropolitan districts in the world.

Edison Presses Button for Seattle's "White Way"

Seattle's new millon-dollar street-lighting system, including 1,350 three-globe standards in the business center, went into service on the evening of Nov. 30, when Thomas A. Edison closed a switch in his New Jersey laboratories which sent an electrical impulse over 3,000 miles of telegraph wire kept clear for the purpose. The simultaneous lighting of the whole downtown section brought forth much civic enthusiasm. Mr. Edison then tapped out congratulation telegraph messages with his own hand to President E. H. Hatch of the Seattle Chamber of Commerce and Councilman O. T. Erickson, representing Mayor Edwards, which completed the measure of satisfaction felt over the "white way" inauguration.

Black Canyon's Location on Colorado River



BLACK CANYON, the site preferred for the proposed Colorado River dam by the engineering board whose report was submitted to Congress last week, is in reality part of Boulder Canyon and is only a few miles downstream from the site which previously won the stronger support and which has come to be known prescriptively as the Boulder Canyon dam site. The engineering experts say the geologic conditions are better at the Black Canyon site, that the rock is not so hard to drill, and that the walls are steeper and nearer together. Both dams would impound about the same amount of water—approximately 26,000,000 acre feet. Each site would permit a 550-ft. dam. Either is acceptable to California and to the upper basin states, and the Swing-Johnson bill permits the alternative site.

Purchases and Mergers

Buffalo, Niagara & Eastern Companies Soon to Consolidate—Atlantic Public Utilities Announces Purchases — Foshay Buys More Plants

APPLICATION will soon be made, it is understood by the Buffalo, Niagara & Eastern Power Corporation to the New York Public Service Commission for permission to merge its various electric utilities into one operating concern capitalized at $250,000,000. The corporation controls the Buffalo General Electric, Niagara Falls Power, Niagara, Lockport & Ontario, Tonawanda Power and Niagara Electric Service companies. A petition from the Buffalo, Niagara & Eastern Power Corporation is already before the commission for permission to acquire the Lockport & Newfane Power & Water Supply Company of Middleport, N. Y., as a step toward Niagara unification.

The Atlantic Public Utilities announces the purchase of a large majority of the common shares of the North American Water Works & Electric Company, which was the North American Water Works Corporation. It also announces that its new subsidiary is acquiring the Maine State Water & Electric Companies, the Keystone Water Works & Electric Corporation and the Eastern Carolina Service Company, together with the electric light and power companies formerly owned by the Cleveland Southwestern Railway & Light Company. The Atlantic Public Utilities also is acquiring through stock ownership the Cleveland Southwestern Railway & Light Company.

W. B. Foshay & Company, Minneapolis, have acquired control of the Newport (Vt.) Electric Light Company and taken over its management. The company serves Newport, Newport Center and Derby and has an investment in total plant of approximately $500,000. The company will be merged later with the Public Utilities Vermont Corporation, whose offices are being moved from Richford to Newport. The Foshay group in Vermont originated with the Clyde River Power Company. In the past 21 months the Nichols properties, serving the Barton district; the Missisquoi Electric Company, serving the Highgate Springs section on Lake Champlain, and the St. Armand Parish and Abercorn (Quebec) properties have been added.

The W. B. Foshay Company of Minneapolis entered the successful bid in the sale of the Williams (Ariz.) municipal water and electric utilities recently. The Foshay company entered two bids, one for $150,150 and the second providing $15,150 cash and the assumption of the city's bonded indebtedness of $140,000. The only other bid submitted was by the Arizona Edison Company, which offered $140,000.

Consolidation of the three public service corporations operating in Macon, Ga., with the Georgia Power Company became effective Dec. 1, when a new charter was issued. Utilities supplying energy to Macon, Barnesville, Forsyth, Griffin, Hampton, Jackson, Jonesboro, Monticello and Thomaston are included.

The Georgia Power Company has purchased the electric light and power plant at Manchester, Ga., from the National Utilities Company and will extend its lines there. The Manchester plant was purchased from the city about a year ago by the National Utilities Company.

At an election on Dec. 5 the voters of Madison, Ga., ratified the agreement of the Mayor and Council to sell the municipal electric distribution system to the Georgia Power Company, which will connect this town to its system.

Sale of the Almond Light & Power Company of Albemarle, N. C., to Ives & Davidson of New York for a consideration said to be $50,000 is reported. Jethro Almond has owned it for eighteen years.

Both the Texas Power & Light Company of Dallas and a company referred to as the "Southern Utilities of Iowa" are reported from Austin, Tex., as interested in the possible purchase of the unused city dam on the Colorado River there. In the case of the first named the municipal plant is reported to be included in inquiries preliminary to negotiations. The lines of the Texas Power & Light are already at the city limits. Legal complications, it is said, would make it impossible to close the sale of the dam for two years.

The Oswegatchie Light & Power Company of Gouverneur, N. Y., has made application to the Public Service Commission for permission to purchase 46 shares of the Hammond Light & Power Company at $250 a share, 200 shares of the La Fargeville Electric Light Company at $175 a share and 62 shares of the Rossie Electric & Manufacturing Company for $1,500.

Negotiations for purchase of the Republic (Wash.) Light & Power Company by the Stevens County Power & Light Company of Colville, Wash., are believed to be under way.

The Shawinigan Water & Power Company of Montreal has made an offer to the stockholders of the Laurentide Power Company to purchase their shares at $227.22 cash or $151.675 cash plus one-tenth full paid no-par common share of the Shawinigan company.

Another Public Ownership Move in Washington

Grange officials throughout the State of Washington, backed by city light department employees in the cities owning municipal power plants, are circulating petitions in an effort to obtain the 50,000 signatures needed to bring before the Legislature Initiative Measure No. 1, known as the rural water-power bill. The measure authorizes the formation of districts of any size in the state for the purpose of owning, constructing, maintaining and operating waterworks and power plants, thus extending to any area of the state the right now had by cities to do these things. The bill would open the way to the formation of so-called superpower systems among municipalities. It is being sponsored by the advocates of municipal power and is expected to be vigorously fought by private power interests.

A.S.M.E. Convention Has Electrical Interest

Papers on Motor Applications and Central-Station Operating Topics Among Those Presented at Society's Winter Convention in New York

DESIGN and operating problems, as well as fundamental theory and basic principles arising in the work of engineers in many fields of activity were covered in the deliberations of the forty-ninth annual meeting of the American Society of Mechanical Engineers, held in New York last week. Notes on some papers which had especial interest for electrical and central-station men follow.

On Tuesday morning J. H. Mansfield, chief engineer in charge of design, Greenlee Brothers & Company, Rockford, Ill., in his paper, "Application of Motors to Special Drilling and Tapping Machinery," brought out the fact that much time was lost in designing machines owing to the manufacturer of motors not making motors of the same size standard.

A paper by R. E. W. Harrison, engineering director, Cincinnati Grinders, Inc., Cincinnati, entitled "Motor Drives for Precision Grinding Machines," alluded to the difficulty experienced because motors are not dynamically balanced for all speeds. The author thought that the tendency was to overmotor machines, this tendency being caused by the economic pressure for greater production. He stressed the use of mechanical bearings instead of sleeve bearings, with the bearings so adjusted that an equal pressure will be exerted on the motor spindle from all sides.

The importance of illumination was stressed on Wednesday at a joint meeting with the Illuminating Engineering Society. As pointed out by M. C. Huse, president of the latter organization, illumination means adequate and proper "daylighting" as well as artificial lighting, and the value of both forms was amply proved by the speakers who followed. Prof. H. H. Higbie, University of Michigan, in a paper prepared jointly with W. C. Randall, Detroit Steel Products Company, outlined a quick, readily usable method by which the amount and distribution of daylight illumination that should be produced by any specific window arrangement in the interior of a building might be predicted. This method includes substantially every foreseeable factor involved in such work and reduces them all to a comparatively simple graphic solution of extremely rapid application characteristics.

Ward Harrison, National Lamp Works, emphatically championed the cause of adequate "daylighting," but was even more appreciative of the definite necessity for sufficient supplementary artificial light during daylight hours. Mr. Harrison urged that mechanical engineers should fully realize the desirability of installing sufficient copper for intense illumination in new structures, even though immediate purposes might not require it, since cost ratios favor such work for original installations.

An evaluation of good light as a factor in production was made in a paper by C. C. Monroe and H. A. Cook of the Detroit Edison Company.

In discussing these papers, Norman Macbeth cited several instances where relatively small expenditures for special lighting installations had obviated the necessity for costly plant additions and mentioned that a recent industrial demand for an intensity of 1,000 foot-candles for special work must wait for filters which will remove or cut off the heat from high-powered sources.

A. L. Powell emphasized the point that industry is now beginning to demand something more than 500-watt units on 10-ft. centers and that lighting engineers are not ready to furnish it for industrial work.

A lively discussion of coal-pulverizing equipment and practice was precipitated at the meeting of the fuels division on Wednesday by W. J. A. Loudon, who alleged that the desirable fundamental design of pulverizing mills is not known and that manufacturers misrepresent performance characteristics and offer absurd and misleading guarantees. J. Van Brunt of the Combustion Engineering Company agreed in general with Mr. Loudon and pointed out that the wide variation in coals offered a misleading factor and that the design of pulverizing mills was inherently weak since performance varied so widely with the wear of the abraded parts.

Prof. Lincoln T. Work of Columbia University suggested the establishment of criteria of "grindability" of coals, as did C. J. Jefferson of the United States Shipping Board. A. E. R. de Jonge, Shanghai Municipal Electrical Department, related difficulties with powdered-coal ash, stating that in spite of guarantees on equipment supposed to segregate 85-95 per cent of the ash in stack gases, none was 50 per cent efficient and that the installation of air preheaters was the only effective way to treat his problem in China.

Other speakers on topics of particular interest to utility men were John C. Somers, Electric Bond & Share Company, who considered the material-handling problem in the public utility; A. Nadai, Germany, whose topic was "Stress Distribution in Rotating Disks of Ductile Material After the Yield Point Has Been Reached"; Prof. A. G. Christie, whose paper dealt with peak-load problems in steam-power stations and who offered a critical study of steam accumulators and their economic possibilities, and W. J. Wohlenberg and R. L. Anthony, whose joint paper, "Influence of Coal Type on Radiation in Boiler Furnaces," supplemented an earlier treatment at a previous A.S.M.E. meeting and reported upon the investigation of the quantitatively measurable property of coals most significant in differentiating one from another during combustion with respect to the quantity of energy transferred as heat to the walls of the boiler furnace. The calorific value apparently served as the most consistent and useful indicator.

Pros and Cons on Project at Cumberland Falls

Kentucky Congressman and Governor Assert that People of State Want Development—Former Governor Denies It—Two Views on Scenery

ADVOCATES of the development of power resources at Cumberland Falls in Kentucky made an effective showing at the public hearing on Dec. 5 before the Federal Power Commission and its staff, to which reference was made last week. The opposition was confined largely to national organizations interested in scenic beauty. Arguments against the project were couched in general terms which were in contrast with the engineering reports and the mass of exact data presented by the staff of the commission and by those who favor the granting of a license to the Cumberland Hydro-Electric Company.

The hearing revealed that the people in a wide region around the falls seem to favor the proposed hydro-electric development, which is combined with a park plan also meeting their approval. To obtain a park without cost, as well as a large taxpaying enterprise, apparently appeals to them as in the public interest. Secretary Jardine established, through a number of questions asked opposition witnesses, that the falls are not to be destroyed, as had been asserted in some of their literature.

Speaking on behalf of the Middle West Utility Company, the Kentucky Utilities Company and the Cumberland Hydro-Electric Company, organized to carry through the project, R. H. Gordon, chief counsel, outlined the progress and scope of the development. Plans call for a dam 80 ft. high and 800 ft. long, 3,500 ft. above the falls, a 19-ft. tunnel cutting off a horseshoe bend and supplying a power plant 4,800 ft. below the falls and a small dam making a cushion pool below the spillway of the main structure. The point was made that neither the dam nor the plant nor the appurtenant works can be seen from the falls and that therefore they do not mar the main scenic feature.

For the opposition, J. C. Doolan, chief counsel, stated that the Kentucky River should be developed before the Cumberland and that building a plant at the falls was not an economic necessity. Former Governor W. J. Fields then spoke, describing Cumberland Falls as "America's greatest scenic asset." He said that artificial falls had been a failure in other countries and that the release of impounded water from behind the proposed dam would therefore not preserve the scenic effect. Governor Fields favored the acceptance of Senator T. C. du Pont's offer, which would make possible a 2,200-acre park without the development, and declared that the people of Kentucky overwhelmingly support him. He pointed out the possibility of large revenue from tourist trade.

Congressman J. M. Robsion vigorously defended the project, asserting that, contrary to Governor Fields' declaration, Kentucky was behind it almost to a man and that instead of ruining the falls it would immeasurably add to their beauty by equalizing the flow over dry periods. Congressman Robsion said that he had not communicated with the power companies.

Similar contentions were put forth by Governor F. D. Sampson, the State Geologist, the secretary of the State Park Commission, judges and private citizens of Kentucky.

In opposition representatives of the National Congress on State Parks, the Campfire Club of America, the National Council of State Parks, the American Civic Association and the Isaac Walton League were heard. Among the points raised was that the greatest draft from storage would be during the tourist season and that therefore a joint park and power plan would be subject to an unsightly lake shore line and depleted falls. Senator du Pont's stand was explained by an authorized representative.

Interest Grows in Tokyo World Congress

Gathering of Engineers to Be Held in Japanese City in October and November Next Year Promises to Be Outstanding Success—American Part Outlined

INTEREST in the World Engineering Congress to be held at Tokyo, Japan, from Oct. 29 to Nov. 7, 1929, already great among American engineers, has been further stimulated by the presence in the United States of Dr. M. Kamo, dean of engineering at the Imperial University in that city, president of the Japanese Society of Mechanical Engineers and chairman of the organizing committee of the coming congress.

Dr. Kamo has just been in Europe and reports an active movement there to insure the proper representation of the Continental nations as well as Great Britain. France, Germany, Sweden, Denmark, Belgium, Italy and Switzerland are particularly eager to bring this about, and at least 75 papers will be contributed from these nations. Dr. Kamo expects about 125 delegates from Europe, and he expresses the opinion that America, which even more than Japan he regards as the originator of the coming congress, and which will contribute 70 or 75 papers, these having been arranged for and subjects assigned by fifty or more engineering societies, should send 200 men to represent her.

The Japanese government is now solidly behind the plan, Dr. Kamo reports. The Prime Minister will take part, the Emperor's brother will officially welcome the delegates, and the Emperor will entertain them at an "imperial garden party" in the grounds surrounding one of his two Tokyo palaces. The opening session of the congress will be held at the auditorium of the university, the committee meetings in the committee rooms of the House of Parliament, and the closing plenary sessions in the assembly chamber of that building. Free travel to any part of the Japanese Empire, including Formosa, will be provided for the delegates and members of their families, and there will be a discount of 15 per cent on passage tickets from any port in the United States to any port in Japan. The great electrical progress evident in Japan, and especially its remarkable water-power developments, completed or under way, should, in Dr. Kamo's opinion, be an especial inducement to electrical engineers to make the journey.

The technical program of the congress is divided into 23 sections, as follows:

1. General Problems Concerning Engineering.—Education, administration, statistics, standardization, international co-operation, etc.
2. Engineering Science.—Strength of materials, thermodynamics, hydraulics, electricity and magnetism, and other scientific researches.
3. Precision Machines and Instruments.
4. Architecture and Structural Engineering.
5. Public Works.
6. Railway Engineering.—Including electrification.
7. Transportation.
8. Communication.—Telegraphy, telephony, wireless telegraphy and telephony, radio broadcasting.
9. Power.—Resources, water-power plants, steam-power plants, utilization of natural steam, tidal power, transmission and distribution, etc.
10. Electrical Engineering.—Generators and motors, transformers and converters, measuring instruments, electric switch gears, power cables, vacuum tubes, electrical heating appliances, etc.
11. Illuminating Engineering.—Electric lamps, illumination, etc.
12. Mechanical Engineering.
13. Refrigerating Industry.
14. Textile Industry.
15. Shipbuilding and Marine Engineering.
16. Aëronautical Engineering.
17. Automobile Engineering.
18. Chemical Industry.—Including electrochemical industry.
19. Fuel and Combustion Engineering.—Solid, liquid and gaseous fuels and their appliances.
20. Mining and Metallurgy.
21. Engineering Materials.
22. Scientific Management.
23. Miscellaneous.

The opening ceremony and general meeting will be on Oct. 29, sectional meetings beginning Oct. 30, with a general meeting and the closing ceremony on Nov. 7. Before the meetings begin there will be, on Oct. 25-27, excursions to Nikko and Hakone: on Saturday, Nov. 2, and Sunday, Nov. 3, excursions in Tokyo and to Yokohama and Kamakura will take place, and after the congress adjourns, from Nov. 8 up to Nov. 22 inclusive, excursions of longer distance to various parts of Japan.

As previously reported in the ELEC-

TRICAL WORLD, the American committee behind the Tokyo congress is headed by Dr. Elmer A. Sperry, with Maurice Holland as executive secretary. Dr. John W. Lieb heads the executive committee in this country.

High-Tension Conference Again Next Year at Paris

Already the Paris secretariat of the Conférence Internationale des Grands Réseaux Electriques à Haute Tension, or International Conference on Large High-Tension Systems, has sent out an official announcement of the date of the biennial meeting next year. This will be June 15-16, and, as usual, the conference will be held in Paris. All papers should be forwarded before Feb. 15 next and should be in both French and English except in special cases.

Special subjects selected for discussion next year, with the "general reporter," are:

Statistics. — Establishment of international statistics on a uniform basis representing the results obtained in the production, transmission and distribution of electrical energy.—Schulz, Norway.

Utilization of Combustible Materials.—Rational utilization of various combustible materials for the production of electrical energy: Rules to be observed in effecting as great an economy as possible in these materials.—Mailloux, United States.

Cables.—Discussion of the technical specifications in existence in the different countries for the supply and testing of high-tension cables.—Spruyt, Holland.

Oil Switches.—Design and testing of oil switches.—Perrochet, Switzerland.

Insulating Material.—Continuation of the investigation in regard to transformer and switch oils.—Weiss, France. Tests and conditions of use of insulating materials other than oil; results obtained with these materials.—Grosselin, France.

Distribution Systems. — Parallel operation.—Roncaldier, Italy. The problems regarding wattless currents in networks for transmission and distribution of electrical energy.—Busila, Rumania. Interconnection of power systems of different frequencies. Neutral earthing.—Del Buono, Italy. Disturbances in operation of interconnected very high power systems of very large development. Direct measurement of energy in the high-tension systems. Influence of high-tension currents on telephone and telegraph lines. Latest research on lightning arresters.

Mark of Quality.—Discussion in regard to the question of agreeing internationally upon a mark to denote quality.—Spruyt, Holland.

The official American delegates are C. O. Mailloux, H. W. Young, J. W. Lieb, A. O. Austin, Frederic Attwood, A. S. Garfield and F. G. Baum. G. Faccioli will represent the National Electric Light Association and six members will represent jointly the United States Committee of the International Electrotechnical Commission and the American Institute of Electrical Engineers. Engineers wishing to register for the conference should apply as soon as possible, inclosing a check for 250 francs made to the order of Tribot Laspière, secretary-general, 25 Boulevard Malesherbes, Paris.

Briefer News

KENTUCKY PUBLIC UTILITIES ASSOCIATION TO MEET IN LOUISVILLE NEXT MONTH.—The Kentucky Association of Public Utilities will hold its annual meeting in Louisville, at the Brown Hotel, on Jan. 15 and 16. There will be an afternoon session on Jan. 15, with a dinner in the evening, and a morning session on Jan. 16.

FORT WORTH'S NEW "ELECTRIC BUILDING."—An eighteen-story concrete building to be known as the "Electric Building" is being pushed rapidly to completion at Fort Worth, Tex., where it will be one of the tallest structures. It will be owned and occupied

by the Fort Worth Power & Light Company. The building will be 94 ft. by 100 ft. for three stories and above that 75 ft. by 100 ft. The outside design is face brick with cast-stone trim.

EMPIRE STATE ASSOCIATION'S ELECTRIC SECTION ARRANGES PROGRAM.—The annual meeting of the Electric Section of the Empire State Gas and Electric Association will be held on Jan. 10 and 11 at the United Engineering Societies Building, New York City. Reports on automatic frequency control, aërial power cables, vibration of overhead conductors, transmission-line insulation, generation of radio interference, applications of parkway cable, relation of rainfall to run-off, recent developments in machine design, series capacitors and suggested practice for rural line construction will be made by the chairmen of the committees within whose purview these topics respectively fall. Addresses by M. S. Sloan and President Charles S. Ruffner of the association are scheduled.

NEW TRANSMISSION LINE FOR SOUTHERN INDIANA. — The Interstate Public Service Company will soon start construction of a 33,000-volt line from Lawrenceburg to Aurora, Ind. The line will be completed in about four months.

GREAT FALLS (MAN.) GENERATING PLANT COMPLETE.—The sixth unit of the Manitoba Power Company's plant at Great Falls, on the Winnipeg River, has been placed in service. This unit of 28,000 hp. is the last and brings the total capacity of the plant to 168,000 hp.

PROGRESS IN PORTO RICO.—Restoration of the plants of the Porto Rico Railway, Light & Power Company, badly crippled in the hurricane of last September, to a condition almost normal is reported by General Manager Frederick Krug of San Juan, who also says that construction of a 7,000-hp. hydroelectric plant at Rio Blanco has begun.

MISSISSIPPI HAS NEW 110-KV. TRANSMISSION LINE.—Greenwood and Durant, Miss., 37 miles apart, are now connected by a 110-kv. transmission line recently finished by the Mississippi Power & Light Company. From a substation outside Durant lines at lower voltage run to Lexington, Vaiden and Goodman, Miss.

DAKOTA PUBLIC SERVICE COMPANY MOVES HEADQUARTERS.—Headquarters of the Dakota Public Service Company have been moved from Fargo to Devil's Lake, N. D., where a new building is being completed for its use. This company is a subsidiary of the Western Public Service Company and owns properties in about thirty-five North Dakota towns and cities.

LINE FROM EVANSVILLE TO SOUTHERN INDIANA COAL MINE FINISHED.—The Southern Indiana Gas & Electric Company of Evansville, Ind., has virtually completed 50 miles of 30,000-volt line from Evansville to Arthur, Ind., to serve the Electric Shovel Coal Corporation. Work on this line began last summer. The mining company will be the utility's largest customer. Its demand may reach 5,000,000 kw.-hr. a year.

PROGRESS OF GEORGIA POWER COMPANY RATE HEARING. — Public hearings by the Georgia Public Service Commission to establish a rate valuation for the Georgia Power Company were postponed last week until Dec. 19. The present valuations are $125,000,000 for the electric department and $150,250,000 including the railway and gas branches, and earnings of 8 per cent are allowed by the commission. President Arkwright presented figures showing that the actual value of the properties is considerably in excess of the valuation. His statement showed assets of $199,-

415,513. It was charged by opponents of the power company that, with plants admittedly worth above $178,000,000 in the state, it had returned a valuation of only $33,000,000 on them for taxes.

SOUTHEASTERN OKLAHOMA HAS NEW GENERATING STATION.—Operation of a new 5,000-kw. generating plant of the Lincoln Power Company, near Howe, in southeastern Oklahoma, has begun. The plant was erected at a cost of about $800,000 to serve coal fields. The Oklahoma Gas & Electric Company has made temporary connections to the plant through a substation at Howe, and when a 13,000-volt transmission line between Poteau and Howe is completed permanent connection will be effected.

POTOMAC ELECTRIC POWER'S PLANT ADDITION.—Construction work is under way on the addition to the Benning steam-power plant of the Potomac Electric Power Company in Washington, which was announced as ordered some months ago. It will have a rating of 30,000 kw., and, together with new boilers and auxiliary equipment, is being installed at a cost, including the building extension, of $2,815,000. The new unit will be ready for service in June, 1929, increasing the capacity of the plant to 178,000 kw.

KENTUCKY UTILITIES COMPANY TELLS OF WORK UNDER WAY.—The Kentucky Utilities Company announces construction involving $107,500 on which work is starting. It includes a 9-mile, 11,000-volt transmission line from Wickliffe to Bardwell, in western Kentucky, to cost $30,000, which will ultimately be converted into a 60,000-volt line and extended 11 miles; a "white way" for the business district of Paducah, to cost about $40,000, and many smaller undertakings.

CLARION, IOWA, THINKING ABOUT MUNICIPAL PLANT.—A proposal to erect a hundred-thousand-dollar municipal electric power plant is under consideration by the Clarion (Iowa) City Council, the Municipal Utilities Company, Des Moines, being the promoter of the project. The building company would supervise the plant and continue in charge until earnings repaid its investment. If formal action is taken on the project, it will then be submitted to referendum vote. Clarion is now served by the Iowa Public Service Company.

NORTHWESTERN ELECTRIC COMPANY'S NEW UNDERTAKINGS.—Further details of the plans for increasing system capacity by about 50 per cent by the addition of a new steam unit at its Lincoln Street plant in Portland, Ore., at a cost of $1,200,000, have been announced by the Northwestern Electric Company. The principal features of the addition are a 27,800-kw. General Electric steam turbo-generator unit and a 2,550-hp. B. & W.-Stirling boiler to operate at 250 lb. pressure. The installation of this equipment will necessitate two additions to the present plant building, which will be of structural steel and concrete. A further improvement contemplated is a reinforced-concrete building adjacent to the present plant, to house the switching and bus structure of the enlarged plant. Completion of the entire improvement is scheduled for Sept. 1, 1929. The company's plans for the possible development of a hydro-electric plant on the North Fork of the Lewis River are more remote, and at the present time no announcement of a definite design for such a development has been made by it.

MANITOWOC (WIS.) MUNICIPAL PLANT TO BE DOUBLED.—Proposals from the Wisconsin Public Service Corporation, which has a generating plant in Manitowoc, Wis., to build an interconnecting line to the municipal power plant to take care of peak loads and to permit the exchange of electrical energy between the two plants have been rejected by the city authorities, who will proceed to double the present capacity of the municipal plant (5,500 kva.) at a cost of $250,000. Work is to begin at an early date, and it is announced that expansion will be paid for out of the earnings of the plant.

CANADIAN SYSTEM MAKES RECORD FOR OUTPUT.—A new high output record for a single Canadian system of 6,054,837 kw.-hr. of electrical energy in a single day has been established by the Canadian Hydro-Electric Corporation, according to announcement from the corporation's headquarters in Ottawa. This record was established on Dec. 3 by stations having a capacity of 642,600 hp. installed and in process of installation. Of this power, 439,000 hp. is generated by plants of the International Paper & Power Company on the Gatineau River, 80,000 hp. at Grand Falls, New Brunswick, and 123,600 hp. in developments on the Ottawa River and its tributaries.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

Electrical Credit Association — New York Division, New York, Dec. 17; W. J. Kreger, 261 Broadway, New York.

Empire State Gas and Electric Association—Electric Section, United Engineering Societies Bldg., New York, Jan. 10 and 11. C. H. B. Chapin, Grand Central Terminal, New York.

American Engineering Council—Annual meeting, Washington, Jan. 14 and 15. L. W. Wallace, 26 Jackson Place, Washington.

Kentucky Association of Public Utilities—Brown Hotel, Louisville, Jan. 15 and 16. E. F. Kelley, Louisville Railway Co., Louisville.

North Central Electric Association — Engineering Section, Minneapolis, Jan. 21-22; Commercial Section, Minneapolis, Feb. 25 and 26. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

National Electrical Manufacturers' Association — Supply Division, Hotel Commodore, New York, Jan. 21-26. S. N. Clarkson, 420 Lexington Ave., New York.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 28-Feb. 1; regional meeting, Cincinnati, March 20-22. F. L. Hutchinson, 33 West 39th St., New York.

Midwest Power Conference — Chicago, Feb. 12-16. G. E. Pfisterer, 53 W. Jackson Blvd., Chicago.

Oklahoma Utilities Association—Oklahoma City, March 12-14. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

DOMESTIC RATES LOWERED AT SPRINGFIELD, MASS.—The United Electric Light Company of Springfield, Mass., has announced a reduction of the rate for domestic lighting from 6 cents to 5½ cents a kilowatt-hour. The customer is to have the further privilege of being billed at his option according to rates based on the floor area of his home. This provides for a minimum floor area charge of 60 cents a month and a commodity charge of 4 cents a kilowatt-hour up to 150 kw.-hr., after which the rate drops to 3 cents. Lighting and appliance consumption are to be measured on the same meter. On approval by the commission the new schedule will become effective Feb. 1.

CITIES IN OREGON COMPETE FOR BETTER LIGHTING SYSTEMS.—The Portland (Ore.) Electric Power Company is largely responsible for a municipal lighting contest which is being carried on between various city governments in Oregon in an effort to extend and improve their street and park illumination. The Portland utility has installed demonstration equipment in a number of cities and has published cost and maintenance figures tending to show the advantages of modern methods over former systems of illumination. Eight cities are said to contemplate an entire alteration of their lighting systems to comply with one of the improved methods introduced by the electric company.

TWENTY-TWO TEXAS FARMS SELECTED FOR ELECTRICAL EXPERIMENTATION.—Farms and ranches of various types, to the number of 22, have been selected by the Texas Committee on the Relation of Electricity to Agriculture upon which to make intensive scientific experiments in farm electrification. This is the first step in a three-year program to determine how electricity can best be adapted to Texas agriculture. The farms are in various parts of the State and represent several types of farming, such as dairy, poultry, general, cotton, truck and ranch. Their selection follows a recent electric survey of 505 Texas farms made by J. E. Waggoner, survey director for the committee.

WISCONSIN POWER & LIGHT TO DEVELOP FOND DU LAC-SHEBOYGAN TERRITORY.—The Wisconsin Power & Light Company has started construction of a 132-kv. transmission line from Plymouth to Fond du Lac, in eastern Wisconsin, as the first step in a transmission and generating system which the company is planning for this territory. At present the line will connect with other high-tension lines at Plymouth, but it will eventually be extended to Sheboygan,

where it will be served by a large generating station which the company plans to build there—one of the largest in the state. Substations are being built at Fond du Lac and Plymouth to step down the energy. Work has been started by the same company on the erection of steel towers to carry a line of the same voltage from Beloit to Janesville, near the Illinois border.

GREAT NORTHERN ELECTRIFICATION COMPLETE EXCEPT IN TUNNEL.—On Dec. 4 the Great Northern Railway began electrical operation of the entire 80-mile stretch of its main line between Skykomish and Wenatchee, Wash., with the exception of about 10 miles through the new tunnel in the Cascade Mountains. This tunnel is to be opened about Jan. 12, it is announced by President Ralph Budd of the railway, and after that date the whole 80 miles will be operated by electricity. For eighteen months the Great Northern has been working to bring electrical operation of the Skykomish-Wenatchee line, and in recent months it has hauled its trains over about 30 miles with electric locomotives.

KANSAS INTERCONNECTION WILL HELP OKLAHOMA TOWNS.—A 30-mile steel-tower transmission line recently built between the generating station of the Empire District Electric Company at Riverton, Kan., and the Neosho River plant of the Kansas Gas & Electric Company at Service, Kan., provides additional power for cities on the lines of those companies in Kansas and Missouri and also for the Empire District Electric Company in northeastern Oklahoma, where several cities are connected with the Riverton plant. A new frequency changer of large size at Riverton and a new 25,000-kw. steam turbine at Neosho now make possible a pooling of resources for the benefit of all. The Empire District Electric Company alone has expended approximately $1,100,000 in improvements to its generating stations and its transmission systems.

COMPETITION DIES HARD IN NEW YORK VILLAGE.—Although the Philipstown Electric Light Company has had a franchise to serve Cold Spring, N. Y., with electricity for four years, the former service company, the Cold Spring Light, Heat & Power, hung on and had 130 customers among the 2,500 inhabitants of the village until Monday of this week, when they awoke to find the old company's distribution system leveled to the ground by order of the village authorities backed by the courts. Thus ended a town fight inspired, it is said, by loyalty on the part of some of the citizens to the company which had served them for thirty years, though its franchise long ago expired. The Philipstown company is a subsidiary of the Central Hudson Gas & Electric Corporation of Poughkeepsie. The Cold Spring company was operated by the J. G. White Management Corporation of New York.

Commission Rulings

SEVEN PER CENT RETURN DECLARED SUFFICIENT.—In what the California Railroad Commission regards as "one of the most important and precedential decisions" rendered by it since the World War, that body, instead of allowing a return of 7½ or 8 per cent according to its custom, has found unanimously that a rate of return of 7 per cent on the capital invested, in the case of a stable and established utility like the Southern Counties Gas Company, is reasonable. This action was taken in fixing the rates for natural gas in Ventura city and county. In view of the "marked decline in the cost of money" during the last few years, the commission held that with the lower rate of return it would be possible for the utility to obtain the needed capital to function properly. The company is said to have been earning 12 per cent.

PROPER PROCEDURE IN HANDLING MONEY PAID FOR RURAL SERVICE CONNECTION.—Money collected by a utility company from prospective patrons as connection charges should be held by and credited to the company with whose lines the connections are to be made, according to the Indiana Public Service Commission, which made this decision in a case affecting the Rush County Power Company. Another company holding such funds was accordingly required to account to the responsible utility. The commission said: "On the whole, the scheme of organization of this company is not to be commended and, were it not for the fact that this service is apparently badly needed by the persons now connected with it, the entire plan would be disapproved and this petition dismissed. However, money for connection charges has been paid by consumers; these people would be left without any service and greater harm would be done probably by refusing to approve than by the approval."

UNIFORM ELECTRIC RATES FOR CITY AND ADJOINING TERRITORY SUSTAINED.—The population of Wichita, Kan., now approximately 100,000, is equaled by the aggregate population of the cities, towns and communities arranged in a closely allied group all around its corporate limits. This entire area has been served at uniform electric rates by the Kansas Gas & Electric Company. Recently Wichita authorities conceived the idea that, since it was the largest city and the keystone of the group, distribution and production cost should be less within its limits, and therefore it was entitled to a lower rate than the suburban communities. The Kansas Public Service Commission, says *Public Utilities Reports*, finally decided this question against the city, pointing out that if there were only one city aside from Wichita, one which was far distant and isolated and from which Wichita was receiving no benefit, it being served at a loss made up out of the proceeds from Wichita, there would be merit in the city's contention. The evidence showed, however, that the rate was not only comparatively one of the most reasonable in the whole state, but that the difference in production and distribution costs as between the suburban communities and the city was not sufficient to warrant any allocation of plant. The commission observed: "To attempt actually or in theory to segregate the system into sections as numerous as the different communities, each with its individual surroundings, and allocate just and proper value to the company's property in each one of them, would tend to destroy all uniformity and probably would prove not only extremely vexatious but impracticable."

NOTICE OF CHANGES IN SERVICE MUST BE MADE TO CUSTOMERS AS WELL AS TO COMMISSION.—The Public Utilities Commission of Colorado has instructed all public utility companies that they must advise each and every customer thirty days in advance of any proposed change in service, the order covering all matters that come under the jurisdiction of the commission and applying to municipally owned utilities as well as to others. Heretofore it was only necessary to advise the Public Utilities Commission.

Recent Court Decisions

CUSTOMER-OWNER NOT ENTITLED TO INTERFERE WITH STOCK-SELLING PLANS NOT INJURIOUS TO HIS INTEREST.—In Murphy vs. the Wyandotte County (Kan.) Gas Company, the owner of one share of stock in the latter sought to restrain the company from using its employees to sell stock in the holding company that controlled the Wyandotte County Gas. The United States District Court dismissed the suit, no other stockholders joining the plaintiff and there being no evidence that the value of the plaintiff's stock was impaired.

TIME LIMITATION AGAINST SUIT TO RECOVER DAMAGES FROM PLANT ASH.—The Arkansas Supreme Court held, in Brown vs. Arkansas Central Power Company, that where a power company had constructed its plant to use slack or soft coal, and where because of the use of such fuel cinders and ashes were blown upon the property of an adjacent owner, the right of action for damages arose at the completion of the plant and beginning of the operation and that the damage was original and not recurrent. Therefore suit not begun within three years after the original damage was barred by the statute of limitations. The appellate court sustained a verdict by a jury under directions from the trial court to that effect.

NO NECESSARY LIABILITY ON OPERATOR OF PLANT BECAUSE OF DEATH MET IN REMOVING FALLEN AND BADLY INSULATED WIRE.—The Springfield (Mo.) Court of Appeals found, in Sanders vs. City of Carthage, that the contributory negligence of a seventeen-year-old boy with little knowledge of electricity who attempted to remove a broken and badly insulated wire from its resting place on a tree was a question for the jury. The municipality, which operated the power plant, had the duty of exercising the highest degree of care and should, after an electric storm, have inspected its transmission wires for possible damage. Its alleged negligence in this regard was also for the jury to decide. The municipality, however, was not liable for damages merely because the wire was not properly insulated, since it is not an insurer but has the duty only of keeping its wires more than reasonably safe. A judgment for the plaintiff was affirmed with certification to the Supreme Court. (9 S.W. [2d] 813.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

Harold B. Smith Selected to Head Institute

Harold B. Smith, professor of electrical engineering and director of the department at Worcester Polytechnic Institute since 1896, has received the official nomination for the presidency of the American Institute of Electrical Engineers. Though Mr. Smith's duties as an educator have been many and exacting, he has by no means devoted himself exclusively to academic work, but rather has he combined educational work with actual engineering practice in the course of an unusually useful and distinguished career.

In 1892, following graduation from

H. B. Smith

Cornell University, he was appointed professor of electrical engineering in charge of the department at the University of Arkansas. Resigning from this position he became head designer and electrical engineer for the Elektron Manufacturing Company, Springfield, Mass., and then spent three years as director of the department of electrical engineering at Purdue University.

Professor Smith retained a connection with the Elektron Manufacturing Company as consulting engineer until 1902 and did consulting work for several other organizations at various times. Since 1905 he has served as a consulting engineer for the Westinghouse Electric & Manufacturing Company. He has been a pioneer in the development of high-voltage power transmission systems and equipment, has carried on many researches involving advanced conceptions of dielectric phenomena and stress distribution and holds numerous patents.

In association work Professor Smith has been very active, having been a member at various times of the co-ordination, education, electrophysics, law, instruments and measurements, sections, student branches, Edison medal, research, meetings and papers, and a number of special committees of the American Institute of Electrical Engineers and he is at present chairman of the committee on code of principles of professional conduct. His other memberships include American Society of Mechanical Engineers, Institution of Electrical Engineers (Great Britain), Society for the Promotion of Engineering Education and American Association for the Advancement of Science.

G. V. Rork Heads Northern States Wisconsin Division

Glen V. Rork has been appointed manager of the Wisconsin division of the Northern States Power Company with headquarters at Eau Claire. Since the resignation of George H. Wilmarth to become chief operating engineer of the company, with offices in Minneapolis, Harold L. Geisse, vice-president and general manager of the Wisconsin Valley Electric Company, has supervised operations of the Wisconsin division. Mr. Rork is a native of Wisconsin. Early in his career he was employed by a subsidiary of the Northern Pacific Railroad in various branches of electrical work. He entered the employ of the Wisconsin-Minnesota Light & Power Company, now the Wisconsin division of the Northern States Power Company, in 1920. Following the purchase of the Midland Public Service Company, with headquarters at Owen, Wis., by the Northern States organization, Mr. Rork developed that company's system from a five-town unit to its present size of 23 towns.

MURRAY J. IDAIL, who at one time was connected with the Newport News & Hampton Railway, Gas & Electric Company, has been placed in charge of the engineering department of the Virginia Public Service Company. His headquarters will be in Charlottesville.

DAVID SARNOFF, formerly vice-president and general manager of the Radio Corporation of America, was promoted to the position of executive vice-president at the meeting of the board of directors held Dec. 7. An early advocate of the broadcasting idea, Mr. Sarnoff has been affiliated with the Radio Corporation of America and its predecessor, the Marconi Wireless Telegraph Company of America, for approximately 22 years.

D. E. BYERLEY, general manager of the Citizens' Light & Power Company, Adrian, Mich., has been appointed vice-president and general manager of the Lenawee County Light & Power Company, recently organized in Michigan by the Doherty interests. Mr. Byerley, who has been active in utility affairs in Michigan for several years, has been identified with Henry L. Doherty & Company since 1912.

J. E. Zimmermann Heads U. G. I. Committee

John E. Zimmermann, who has been appointed chairman of the executive committee of the United Gas Improvement Company with temporary full executive powers, as announced in the December 8 issue of the ELECTRICAL WORLD, has been an outstanding figure in public utility and industrial circles for a number of years. He brings to the chairmanship a broad background of experience not only as an engineer, who has directed the actual construction of plants, but also as a consultant in executive problems relating to the development of public utility enterprises.

J. E. Zimmermann

Mr. Zimmermann is a native of Buenos Aires and received his education there. After transferring his interests to this country he became connected with the George V. Cresson Company of Philadelphia, subsequently affiliating himself with the American Pulley Company. It was in 1907 that he became a member of the engineering firm of Dodge & Day, which is now Day & Zimmermann, with Mr. Zimmermann occupying the presidency.

At the present time Mr. Zimmermann is president of Day & Zimmermann Securities Company, the National Public Service Company, the Indiana, Columbus & Eastern Traction Company, and vice-president of the Day & Zimmermann Engineering & Construction Company. In addition he serves on the directorate of a number of public utility and industrial companies. Mr. Zimmermann is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, and other technical organizations.

EDWARD DEAN ADAMS has been elected an honorary member of the Louvain Society of Engineers. Mr. Adams has been serving as chairman of the Committee on War Memorial to American Engineers.

C. F. Terrell Now in Texas

Charles F. Terrell, formerly general superintendent of the light and power department of the Tampa Electric Company, has been appointed operating manager of the Eastern Texas Electric Company, to succeed E. S. Fitz, who has assumed new duties in Virginia. Mr. Terrell brings to his new position in Beaumont a record of 25 years of service with the Stone & Webster organization marked by continuous advancement. In the course of this association he has been connected with the Seattle Electric Company, the El Paso Electric Company and the Tampa Electric Company. He is a graduate of the University of Washington in electrical engineering and a member of the American Institute of Electrical Engineers.

WALTER F. NORTON has been appointed manager of the Nashua district of the Public Service Company of New Hampshire to succeed the late George L. Sadler. Mr. Norton had been superintendent of the gas department in the Nashua district since 1897. He began his career in the public utility field in 1890 in the meter department of the Nashua Light, Heat & Power Company.

M. K. FOXWORTHY, who recently became affiliated with an Indianapolis coal company, was honored recently at a luncheon of the Electric League of Indianapolis at the Chamber of Commerce Building. Mr. Foxworthy formerly was commercial manager of the Indianapolis Power & Light Company. He resigned as president of the league at the meeting because of a change in business. He was presented with a sheepskin parchment bearing the names of the members of the league. A. J. Callaway, vice-president of the league, will be president until the annual election of officers late in December.

E. S. FITZ, operating manager of the Eastern Texas Electric Company, Beaumont, Tex., since 1924, is now connected with the Virginia Electric & Power Company in Richmond, Va. His connection with Stone & Webster dates back to 1911, when he entered the meter department of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I. He has served with the Houghton (Mich.) Electric Light Company and the Houghton County Traction Company. Mr. Fitz was graduated in electrical engineering from Brown University, Providence, R. I.

WILLIAM W. TEFFT, who has been chief engineer of the Commonwealth Power Corporation for the last five years, has resigned to devote his entire time to his consulting engineering practice with headquarters in Jackson, Mich., where he has resided for many years. His connection with the Commonwealth properties began in 1902, and continued throughout his association with the late W. A. Foote, long known as the "Father of Consumers Power Company," and until the properties in Illinois, Ohio, Indiana and Tennessee became a part of the corporation. For some years preceding his appointment as chief engineer of the Commonwealth he was a member of the firm of the Fargo Engineering Company, the activities of which extended throughout the country. Mr. Tefft is the inventor and owner of the Tefft conduit spillway and accelerator, which has been installed in several large hydro-electric developments during the last few years. Always active in the educational life of Michigan, he is president of the board of trustees of Albion College, which position he has held for the last seven years.

G. S. Humphrey Elected to Vice-Presidency

George S. Humphrey, who became chief engineer of the Potomac Edison Company two months ago, has just been elected a vice-president of that

G. S. Humphrey

company and will have charge of operations and engineering for it and its subsidiary companies, reporting direct to the president. Mr. Humphrey affiliated himself with the Hagerstown utility in October after serving for ten years in the capacity of electrical engineer for the West Penn Power Company with headquarters in Pittsburgh.

Following graduation from the Massachusetts Institute of Technology in 1910, Mr. Humphrey's first connection was as an employee of the Telluride Power Company at Provo, Utah. Subsequently when that company was consolidated with the Utah Power & Light Company in 1912 he removed to Salt Lake City. He remained with the Utah company as distribution engineer until 1918, when he transferred his interests to Pittsburgh. Mr. Humphrey has devoted considerable attention to association work, having been chairman of the electrical section of the Engineers Society of Western Pennsylvania, chairman of the Pittsburgh section of the American Institute of Electrical Engineers and chairman of the engineering section of the Pennsylvania Electric Association.

O. W. WALTER, formerly assistant professor of electrical engineering at the University of Oklahoma, is now affiliated with the Hall Electric Heating Company, Philadelphia, Pa., in the capacity of engineer.

Obituary

Andrew J. DeCamp

Andrew J. DeCamp, who recently retired after serving more than 40 years as general manager of the Philadelphia Electric Company, died Dec. 11 at his home in Philadelphia as a result of pleurisy. He was 86 years of age. Mr. DeCamp was the oldest employee of the Philadelphia utility, having entered its employ in 1881. Under his supervision the first electric street lights were installed in Philadelphia on Chestnut Street and he also directed the installation of the lighting system in the Broad Street station about that time. In 1881 he became identified with the Philadelphia Brush Light Company, where his progressive ideas and practical accomplishments resulted in his being appointed secretary and general manager the following year. When the various neighborhood companies that now form the Philadelphia Electric Company were merged Mr. DeCamp continued as general manager until his retirement last July, although for the past ten years he had not been active.

JOHN E. YORKSTON, consulting engineer of the General Electric Company, died suddenly Dec. 10 in his office at the Schenectady plant. Mr. Yorkston was 70 years of age. He was a veteran in the employ of the General Electric organization, having become identified with it in 1894 as a designing draftsman. In a short time he was placed in charge of the alternating-current drafting department and in 1902 was made assistant engineer of the works drafting department. Five years later he was appointed engineer in charge of the department. It was in 1922 that he was made consulting mechanical engineer.

JEREMIAH J. SULLIVAN, financier and one of the founders of the Philadelphia Electric Company, died at his home in that city Dec. 11 in his ninety-first year. Long a leader of independent traction interests in the Quaker City, Mr. Sullivan for many years before his death had been president of the Union Traction Company of Philadelphia and also of the Frankford & Southwark Philadelphia City Passenger Railroad Company, the oldest street railway company in Pennsylvania. He had been a member of the board of directors of the Philadelphia Electric Company since its inception and at the time of his death, besides his local traction interests, he held executive positions with lighting companies and other electric railway companies in various parts of the country. Mr. Sullivan was also a vice-president and director of the Continental Equitable Tile & Trust Company.

Financial and Statistical News

Extra Dividends Declared

Among the extra dividends declared during the past week several were by utility and electric manufacturing companies. Continental Gas & Electric Corporation declared an extra cash dividend of $7 per share on the common stock in addition to a quarterly dividend of $1.10 per share on the same stock. Both are payable Jan. 2 to holders of record Dec. 12. There was also declared the regular quarterly dividend of $1.75 per share on the 7 per cent prior preference stock, payable Jan. 2 to holders of record Dec. 12. The directors of the Philadelphia Company have declared an extra dividend of 75 cents per share in addition to the regular quarterly dividend of $1 per share on the common stock, both payable Jan. 31 to holders of record Jan. 2. The regular dividends of the General Electric Company were declared at a meeting of the board of directors of the company on Dec. 7, amounting to $1 per share on the common stock and 15 cents per share on the special stock, payable Jan. 25 to stockholders of record as of Dec. 19. In addition, an extra dividend of $1 per share, payable on the same date, was declared on the common stock from the surplus of the company accumulated from the financing of time installment sales, which surplus had been set aside as a reserve, as stated in the 1926 annual report, and which amounted to upward of $5,000,000, and from the increase during the present year in income from investment and sources other than regular sales.

Recent Listings

The New York Stock Exchange has authorized the listing on or after Dec. 21 of $15,068,800 additional capital stock of the Detroit Edison Company (par $100) upon official notice of issuance and sale and payment in full, making the total amount of stock applied for $106,048,800. There have also been listed on the big board twenty-five-year 5 per cent gold debenture bonds of the Columbia Gas & Electric Corporation amounting to $5,000,000, making the total amount applied for $50,000,000. The New York Stock Exchange has also authorized the listing of 246,662 additional shares of common stock without par value of the Engineers Public Service Company on official notice of issuance in exchange for common stock of Puget Sound Power & Light Company (or scrip certificates issued in exchange for common stock of Puget Sound Power & Light Company), making the total amount applied for 1,896,567 shares. There have also been authorized for listing additional first and refunding mortgage gold bonds, 5 per cent series B, of the New Orleans Public Service, Inc., to the amount of $5,000,000, making the total amount applied for $18,000,000. The New York Stock Exchange has authorized the listing of $100,000 additional common stock of the Pacific Gas & Electric Company on official notice of issuance, making the total amount of common stock applied for $71,291,150. Additional common stock of the Southern California Edison Company has been authorized for listing by the New York Stock Exchange to the amount of $3,125,000 on official notice of issuance and payment in full, with authority to add $1,875,000 stock on official notice of issuance and payment in full and removal of restriction and for cancellation of authorization to list $230,600 of common stock out of the $4,160,300 authorized to be listed July 14, 1926, making the total net amount to be added to the list $4,769,400, and making the total applied for $61,576,450.

New Utility Financing Active

NEW offerings of electric light and power securities in the week ended Dec. 13 totaled approximately $28,000,000, six utility companies participating in the week's activities. The Duquesne Light Company issued 5 per cent cumulative first preferred stock to the amount of $7,500,000 at 100 and accrued dividend, to yield 5 per cent.

Convertible gold debenture bonds of the New England Gas & Electric Association were offered at 97 and interest, yielding about 5¼ per cent, a piece of financing representing a total of $6,000,000. An aggregate of $3,000,000 bonds in the order of surrender for conversion will be convertible on terms to be set forth in the indenture on the first of any month through Sept. 1, 1931, into $5.50 dividend series preferred shares at the rate of ten shares for each $1,000 bond.

A five-million-dollar issue was brought out by the Power, Gas & Water Securities Corporation, organized under the laws of the State of Delaware, for the purpose of assisting established public utility companies in the readjustment of their capital structures and in refunding operations. This offering was in the form of 5 per cent collateral trust gold bonds (with common stock purchase privilege), the price being 99 and accrued interest.

With the purpose of providing funds for additional investments and for other corporate purposes the Union Power Corporation made an offering of 6 per cent secured convertible gold bonds totaling $1,500,000 at 96½ and interest, yielding over 6.35 per cent. These securities, dated Dec. 1, 1928, and maturing Dec. 1, 1943, may, at the option of the holder, be converted prior to maturity into class A participating common stock.

The American Superpower Corporation issued 80,000 shares of first preferred stock, $6 series, at $99.50 a share and accrued dividends, to yield 6 per cent. Proceeds from the sale of this first preferred stock and from the sale of additional class A common stock now being offered to common-stock holders will be used for the acquisition of additional interests in certain electric light and power companies and for other corporate purposes.

Participating class A stock of the Western Power, Light & Telephone Company, numbering 65,000 shares, was issued during the week under review.

Development of Electricity in Bulgaria

There has been a gradual advance in electric power developments in Bulgaria in the past several years as shown in a report of the Ministry of Agriculture. The number of wire systems distributing electric power has increased considerably as compared with pre-war years. At the end of 1900 there was only one system in operation and in 1914 the number had been increased to four. The greatest progress was made between 1923 and 1927; ten systems were in operation at the end of 1923 and 74 at the end of 1927. The ownership of these transmission systems is divided as follows: Twenty-six are the property of different communes, 27 are owned by co-operative associations and banks, seven by joint stock companies, and fourteen are privately owned.

There are 30 hydro-electric stations actually in operation in Bulgaria. Of these stations, eleven have a capacity up to 100 hp., eleven from 100 to 500 hp., four from 500 to 1,000 hp., two from 1,000 to 2,000 hp., and two above 2,000 hp., one of 3,720 hp. and the other of 7,800 hp.

The total energy produced by these hydro-electric stations during 1927 was 25,634,994 kw.-hr.

There were 109 steam stations in Bulgaria at the close of 1927, of which the principal are situated in the districts of Plovdiv and Bourgaz. Of these stations, 60 have a capacity up to 100 hp., 29 from 100 to 500 hp., five from 500 to 1,000 hp., four from 1,000 to 2,000 hp., and two stations have above 2,000 hp.

The total electric production of the steam stations during the year 1927 is estimated at 11,097,540 kw.-hr.

Record Manufacturing Operations

Productive Activity in November, Based on Consumption of Electricity, Shows Gain of 17.2 per Cent

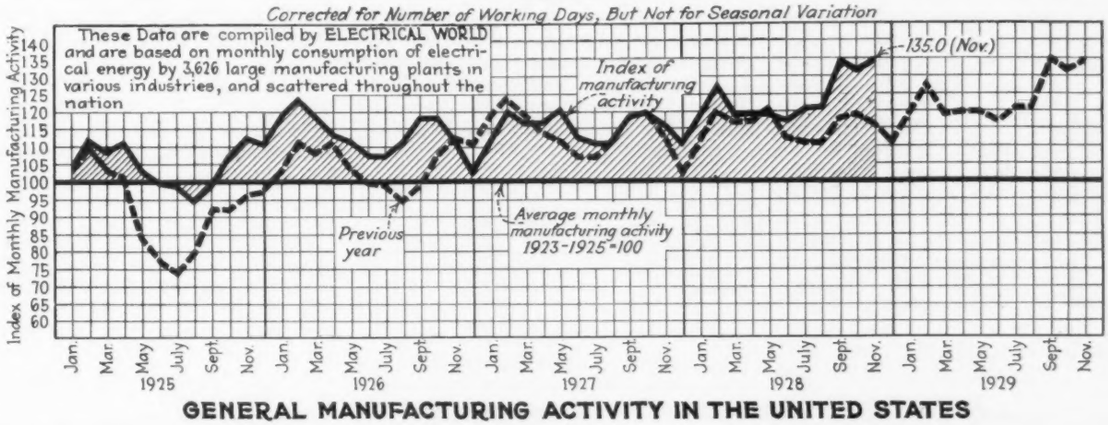
THE rate of activity in the manufacturing plants of the nation as indicated by the monthly consumption of electrical energy was of record proportions during November and 17.2 per cent over the corresponding month last year, according to reports received from more than 3,600 manufacturing plants by the ELECTRICAL WORLD. All of the primary manufacturing groups with the exception of leather products and lumber and its products showed a higher rate of operations than that of November, 1927. Contrasted with October of the current year general activity increased by 2.2 per cent.

The previous peak of manufacturing operations in 1928 occurred in September, but the November operations were about 0.4 per cent above those of September, after corrections are made for the number of working days. The trend in manufacturing production during the current year is entirely different from that witnessed last year. A distinct downward trend in manufacturing operations was witnessed this time last year, whereas the current trend is upward despite the unusually high rate of production which has prevailed since last July. There is every reason now to believe that the entire winter season will witness an unusually high rate of industrial activity, materially above that of 1926 or 1927.

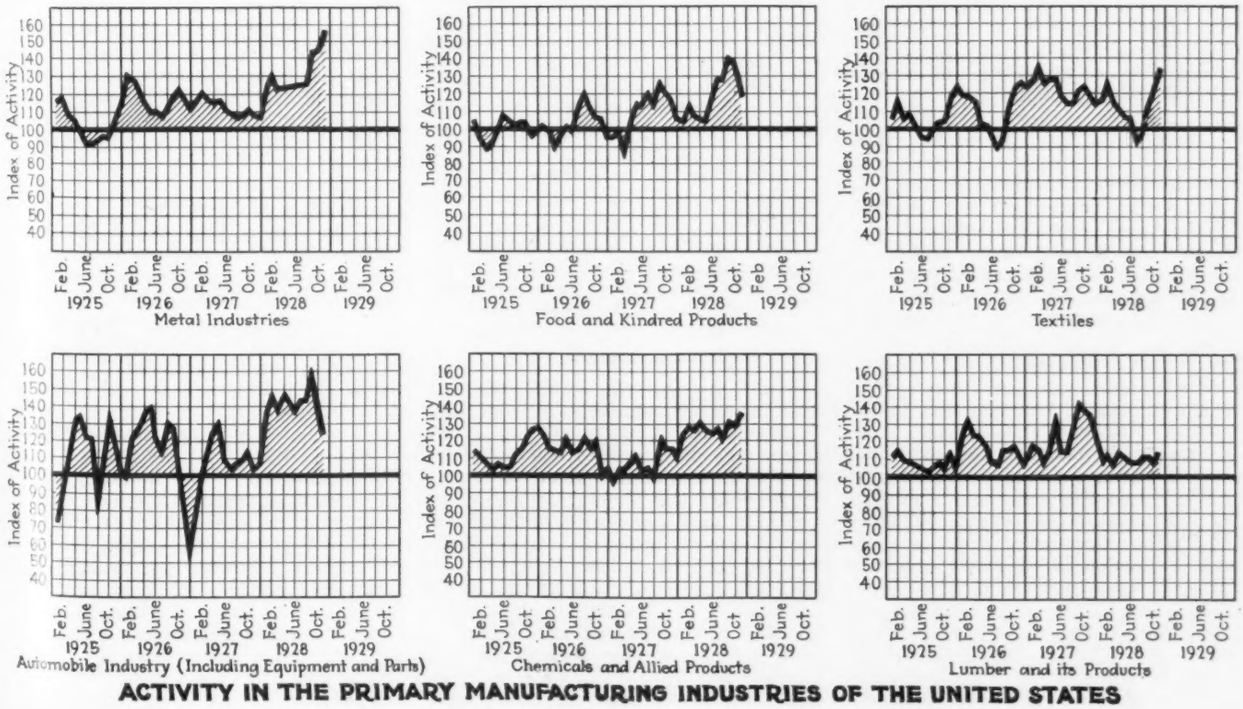
The continued high productive operations in the metals industry group and the continued gain in textile operations are the two outstanding items of the past months. Consumption of electricity by the same plants indicates that the rolling mills and steel plants of the nation were operating during November at a rate 2.8 per cent above October and 36.7 per cent over November last year. The ferrous and non-ferrous metal working plants also increased their rate of operations to the highest on record and 47.3 per cent over November last year.

The November rate of operations in the textile plants of the nation were of record proportions for 1928 and have been exceeded only once in the history of the industry. Operations during that month were 9.5 per cent over October and 11.1 per cent over November, 1927. These increased operations over last year, however, are confined to the Northern States, the textile industry in the Southern States still reporting operations under those of last year.

The automobile industry, including the manufacture of repair and replacement parts, recorded a drop in rate of operations of about 10.2 per cent in November as compared with September,


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of manufacturing activity
135.0 (Nov.)
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Manufacturing Activity
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

but activity in the industry was fully 26 per cent greater than in November last year.

With the exception of the Southern States, all sections of the country reported a higher rate of operations than a year ago. November manufacturing operations in New England were 14.9 per cent greater than in the same month last year. Plants in the Middle Atlantic States were operating at a rate 25.8 per cent above last year. The North Central States recorded a gain of 30.8 per cent and the Western States 28.0 per cent. General manufacturing activity in the South was 7.4 per cent under last year.

UNION ELECTRIC STOCK INCREASE APPROVED.—Increase of the capital stock of the Union Electric Light & Power Company of St. Louis was approved and certificate issued by the Secretary of State Dec. 3. The increase provides for issuance of 420,000 additional shares of the common stock of the company.

ITALIAN OUTPUT GAINS DURING CURRENT YEAR.—Total electric power output for the first nine months of 1928, representing 85 per cent of the Italian electric generating plants, was 6,082,000,000 kw.-hr., as compared with 5,446,000,000 kw.-hr. in the corresponding period of 1927, according to an analysis made by Giuseppe Toeplitz, vice-chairman of the board of the Italian Superpower Corporation and executive head of Banca Commerciale Italiana of Milan. This represents an increase of approximately 12 per cent. Southern and insular Italy, considered as a unit, showed the greatest rate of increase, although 70 per cent of the power generated in Italy is consumed in the northern section. A survey made by the Italian Hydrographic Service shows the present total generating capacity of existing power plants to be 3,400,000 kw., of which approximately 80 per cent is produced by water power, and only 20 per cent by steam plants.

JAPAN ELECTRIC BOND & SHARE ELECTS NEW OFFICERS. — The Japan Electric Bond & Share Company, organized two years ago by American, English and Japanese interests, has elected Sir Kengo Mori, K.B.E., to be chairman of the board of directors; Y. Matsunaga, to be president, and Henry A. Chapman to be managing director. Sir Mori is one of the best-known Japanese in Europe and America and was for many years Japanese financial commissioner to this country, England and France. Mr. Matsunaga is president of the Toho Electric Power Company and a director of the Tokyo Electric Light Company. Mr. Chapman, a resident of Japan, is an English director of Sale & Company of London and Tokyo. American interests associated with the Japan Electric are Guaranty Trust Company, International General Electric Company and Electric Bond & Share Company through its subsidiary, the American & Foreign Power Company.

Construction Costs Utility Companies $800,000,000

The capital requirements of the light and power industry for extensions and improvements are graphically illustrated by figures announced by the statistical research department of the National Electric Light Association comparing expenditures during the past three years with the expenditures of the railroads. The gross amount spent for new construction by these two branches of public service during this period is as follows:

Year	Spent by Railroads	Spent by Electric Light and Power Companies
1926	$885,086,000	$772,515,000
1927	771,552,000	793,744,000
1928 (estimated)	650,000,000	800,000,000
Total	$2,306,638,000	$2,366,25000C

An analysis of the expenditures of the light and power industry is interesting. For example, more than twice as much is spent for the purpose of getting the current to the consumer as is spent to generate it. More than twice as much is spent for plants generating by steam as is spent on water power plants. In fact, the investor's dollar is being split up by the industry approximately as follows:

	Cents
For steam generating plants	19.7
For water power plants	8.8
For transmission lines	17.7
For distributing systems	27.7
For substations	15.0
Miscellaneous	11.0
Total	$1.00

It should be emphasized that of all the money which is being spent for the extension and betterment of the light and power service of the United States less than 9 per cent is going into hydro-electric development. This is directly in line with the statement made by Thomas A. Edison recently calling attention to the fact that the importance of water power is waning and that advancement in the art of generating electricity by steam is the outstanding problem engaging the interest of the industry.

It is interesting to note that the annual requirements for new capital of the light and power companies is approximately four times the total investment 40 years ago.

STONE & WEBSTER ISSUES BOOKLET ON CONOWINGO.—Stone & Webster, Inc., designers and builders of the grreat Conowingo development, just completed on the Susquehanna River to supply Philadelphia and lines reaching north and east, have now issued an illustrated booklet describing the basis of co-operation between banker and engineer behind this huge power job, as well as the job itself. The booklet employs every resource of the graphic arts, including color photography for perhaps the first time on such work. It shows the manifold services unknown to the general public and the almost limitless engineering and financial experience needed to bring a vast project like Conowingo into being as a public utility. The Conowingo plant marks the biggest step forward in the development of the natural power resources of the country that has been taken in recent years, and the Conowingo book is an important contribution to the literature of modern power engineering and the science of public utilities.

GENERAL PUBLIC SERVICE EQUITY UP.—General Public Service Corporation reports total assets on Nov. 30 of $23,695,000, making the common stockholders' equity $32.09 per share, an increase of 61.6 per cent in twelve months in the face of a 6 per cent increase in the number of common shares outstanding.

TIMKEN ROLLER BEARING COMPANY INCREASES CAPITAL. — Stockholders of the Timken Roller Bearing Company approved the plan for a change in capital stock from 1,250,000 no-par common shares to 2,500,000 no-par common shares, effective Dec. 27.

ENGINEERS PUBLIC SERVICE ADDS TO DIRECTORATE.—Following the recent acquisition by the Engineers Public Service Company of the Puget Sound Power & Light Company, the Engineers directors at a meeting held Dec. 6 elected as additional directors W. Cameron Forbes, partner of J. M. Forbes & Company of Boston and Governor-General of the Philippines under President Taft, and Thomas N. Perkins of the Boston law firm of Ropes, Gray, Boyden & Perkins. Both men have been connected with the Puget Sound Company for more than 30 years and are now among its directors.

UTILITY MERGER ANNOUNCED IN GERMANY. — Plans to merge Licht & Kraft, the German utility company, with Siemens & Halske have been announced, together with the declaration of a stock dividend of 10 per cent on the common stock of Licht & Kraft. In addition to the dividend of 10 per cent, common stockholders of Licht & Kraft will receive the right to subscribe to new stock at the rate of one new share for each four shares held. Payment of the 10 per cent stock dividend and increasing the outstanding stock capitalization by 25 per cent will bring the total par value of shares outstanding to 30,000,000 marks. Five million marks, par value, of the stock of Licht & Kraft is to be exchanged for stock of the Siemens & Halske Company in the merger plan. The authorized stock capitalization of the Siemens & Halske Company is to be increased to 100,000,000 marks, of which 96,000,000 marks, par value, will be outstanding following the exchange of securities. Instead of placing control of the Licht & Kraft Company directly under the management of the Siemens company, two directors of each company will be elected to the board of the other company.

Business News and Market Conditions

Kettering Sees Bright Prospect

"THERE has never before been a more encouraging period from a general business standpoint," declared C. F. Kettering, vice-president of General Motors, at the December meeting of branch managers and distributors for the United States and Canada at Dayton. "There is not a cloud in the sky so far as general business conditions are concerned for the next year. The American people and American industries are traveling at an entirely new pace. People generally want better things and are willing to work in order to be able to buy them.

"Political and economic bugaboos no longer impede business by destroying public confidence. People of today walk with heads up, unafraid, and eyes open to fathom the future."

Volume of Building Up 16 per Cent

Building operations in the United States as reflected in building contracts awarded show an increase of 16 per cent for the year to date over the same period of 1927. The total to date is $3,035,459,000.

An analysis of contract figures by sections of the country shows that the largest volume of building took place in the Middle Atlantic States and that the largest increase was in this area. In New England a slight falling off took place, as was the case also in the far West and in the area west of the Mississippi. The Middle West shows a substantial increase, as does also the South.

Reflecting the steady expansion in volume of business the largest single group under building and construction was that of commercial buildings, which accounted for $1,585,663,000. The program was heavy also in the case of streets, roads and bridges.

According to the F. W. Dodge Corporation, new construction started in the 37 states east of the Rocky Mountains during the first eleven months of this year, amounting to $6,195,529,800, shows an increase of 6 per cent over the amount started during the corresponding period of last year. The territory covered in the 37 states represents about 91 per cent of the country's total construction.

Nation Imports $2,000,000 Electrical Equipment

Almost $2,000,000 worth of electrical apparatus was imported into the United States during the first three quarters of 1928, according to statistics released by the Bureau of Foreign and Domestic Commerce. The figures showed progressive increase during the period.

Japan was the largest source of this equipment, Sweden coming second and Germany third.

Imports of Electrical Apparatus Into the United States

Article	First Quarter	Second Quarter	Third Quarter
Carbon-filament incandescent electric lamps:			
Miniature	$64,450	$116,600	$233,146
Other lamps	79,492	94,872	84,468
Metal-filament incandescent electric lamps:			
Miniature	3,053	10,501	15,366
Other lamps	24,052	29,687	8,687
Other electric lamps, including neon, etc.	482	2,238	5,241
Generators	77	.....	.....
Transformers	757	.....	.....
Converters, double-current and motor generators, dynamotors and other converting apparatus	.....	.....	.....
Switches, circuit breakers, fuses, choke coils, reactors, sockets, plugs, etc.	491	1,197	37
Motors, stationary, railway, vehicle, automotive, and other	112	461	26,377
Electric fans and blowers	262	955	1,041
Table household, kitchen and hospital utensils and similar hollow or flat ware containing electrical heating element:			
Electric flatirons	6	4	227
Iron or steel-enameled or glazed with vitreous glasses	653	181	193
Copper, brass, steel or other base metal	300	272	418
Industrial electric furnaces and ovens	.....	86	68
Therapeutic apparatus and X-ray machines	6,331	1,313	1,930
Radio and wireless apparatus and parts	51,904	49,296	40,332
Telegraph apparatus	1,076	1,811	888
Telephone apparatus	1,337	360	171
Spark plugs	125	.....	.....
Storage batteries and parts	2,934	5,252	977
Batteries other than storage	1,363	837	970
Electrical machinery and parts	207,543	115,240	190,447
Electric apparatus and parts	81,169	203,835	142,286
Total	$527,844	$635,123	$753,272

COUNTRY OF ORIGIN

Country	First Quarter	Second Quarter	Third Quarter
Austria	$8,283	$15,466	$11,308
Australia	3,784	.....	.....
Azores and Madeira Islands	.....	.....	.....
Belgium	21	510	1,340
Brazil	18	.....	12
British Honduras	10	.....	.....
British West Indies	.....	.....	.....
Canada	5,991	4,410	9,464
Ceylon	.....	.....	.....
China	3,486	2,426	.....
Cuba	247	12	13
Czechoslovakia	1,354	2,447	19,472
Denmark	53	4,923	.....
France	11,863	9,426	19,788
French Oceania	.....	.....	.....
Germany	163,975	111,426	95,956
Gibraltar	.....	.....	20

Country	First Quarter	Second Quarter	Third Quarter
Hungary	.....	.....	.....
Irish Free State	.....	.....	.....
Italy	$2,932	$120	$314
Japan	90,429	204,285	305,071
Mexico	100	.....	50
Netherlands	2,744	438	1,021
Norway	525	175	.....
Panama	.....	15	.....
Philippine Islands	.....	.....	.....
Poland and Danzig	.....	.....	4
Portugal	6	.....	.....
Rumania	.....	.....	.....
Spain	.....	.....	13
Sweden	119,328	183,476	121,043
Switzerland	54,381	47,772	120,184
United Kingdom	58,314	47,796	48,199
Total	$527,844	$635,123	$753,272

Value of Contracts by Sections in the United States and Total for Canada, October, 1928

Thousands of dollars (-000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to Date, U. S.	Canada
Water-works	.....	$43,211	$139	$285	$1,319	$923	$45,877	**$85,705**	$65
Sewers	$297	3,654	965	1,094	1,007	244	7,261	**86,389**	231
Bridges	435	815	4,221	1,638	1,639	579	9,327	**102,437**	30
Excavations, drainage, etc.	63	133	110	902	49	274	1,531	**31,584**	334
Streets and roads	1,396	10,077	4,792	11,124	12,275	7,429	47,093	**557,625**	559
Industrial buildings	1,930	7,453	30,555	5,007	2,233	6,882	54,060	**286,895**	2,060
Commercial buildings	8,075	81,631	4,034	32,346	15,737	9,586	151,409	**1,585,663**	10,496
Federal government	98	2,107	308	624	2,013	1,194	6,344	**59,834**	.....
Unclassified	262	7,403	22	3,299	15,191	3,555	29,732	**239,327**	1,125
October, 1928	12,556	156,484	45,146	56,319	51,463	30,666	352,634	.....	14,900
September, 1928	10,955	134,554	24,792	51,501	41,250	22,159	285,211	.....	10,149
October, 1927	9,360	81,485	21,994	53,262	46,591	39,296	251,988	.....	29,795
Year to date, 1928	**189,022**	**1,168,878**	**248,490**	**704,502**	**447,938**	**276,629**	.....	**3,035,459**	**132,053**
Year to date, 1927	197,589	778,686	207,624	647,601	462,654	324,446	2,618,600	.....	118,332

Market Conditions

NEW ENGLAND and Eastern district manufacturers are kept busy providing the power companies with motors and other equipment. One engineering company reports electrical equipment contracts totaling $4,000,000. Elsewhere in the East business last week was largely routine.

The feature of the week in the Middle West district is business arising out of the enormous building program under way. There is nothing outstanding in the regular equipment lines either here or in the St. Louis area. On the Pacific Coast orders have been below normal and confined largely to current needs.

Non-Ferrous Metal Markets Continue Quiet

Buying of the non-ferrous metals during the last week has been the quietest in almost every instance that has been experienced in several months. Prices, in general, are quite firm and few indications of weakness have been observed. The total of copper sales is appreciably below the low mark reported last week. Lack of strength in the London lead market appears to have kept domestic consumers out of the domestic market during the early part of the past week, though the demand has improved considerably in the last few days.

NEW YORK METAL MARKET PRICES

	Dec. 5, 1928 Cents per Pound	Dec. 12, 1928 Cents per Pound
Copper, electrolytic	16	15
Lead, Am. S. & R. price	6.50	6.50
Antimony	9.875	9.6875
Nickel, ingot	35	35
Zinc, spot	6.70	6.70
Tin, Straits	51.50	49.875
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Dec. 12, 1928, 17¼ cents.

Quiet Market with Active Spots in Southeast

Activities in the Southeast were quieter last week than the week before, both in the wholesale and retail lines, but reasonably satisfactory business is reported. There is some good central-station business in propect, but orders coming through at this time are individually small. One company ordered creosoted pine poles totaling $4,800 and $3,700 in metering equipment. One of the large power companies in this section has recently completed campaigns in which 113,900 "Mazda" lamps and 1,295 commercial lighting units were sold. Lamp sales over the territory generally are good, as are sales of weatherproof sockets; one jobber states his sales of these sockets in the past two weeks have exceeded 10,000.

An industrial plant in Louisiana placed an order for switching equipment amounting to $50,000, while a phosphate plant in Florida ordered a rotary drier costing $20,000. A stone quarry in Georgia has let contracts covering a new plant and is in the market for 500 hp. in motors, a 600-kva. substation equipment and wiring materials approximating $5,000. Construction projects are as follows:

The Shenandoah Valley Canning Corporation, Harrisonburg, Va., contemplates a new factory reported to cost close to $75,000. The Union Light, Heat & Power Company, Covington, Ky., plans a power substation to cost $40,000. The Harriman Company, operated by the Mead Pulp & Paper Company, Chillicothe, Ohio, plans a paper mill at Harriman, Tenn., to cost $800,000. The Sparta Spoke Works, Sparta, Tenn., will build an addition to its factory to cost $60,000. The Imperial Printing & Finishing Company, Providence, R. I., will build a mill at Rock Hill, S. C., to cost $1,000,000. The Firestone Tire & Rubber Company, Akron, Ohio, plans a factory branch and distributing plant at Jacksonville, Fla., to cost $400,000.

Central-Station Business Active in Eastern District

Central-station business continues to advance in the Eastern district both with regard to current orders and inquiries. A metropolitan power company has placed a commitment for network protectors to cost $180,000 and has contracted for a quantity of metal-clad switching apparatus to an amount of $60,000. A New Jersey central station has placed commitments for a quantity of transformers and other kindred electrical equipment, while a Connecticut power utility has purchased a synchronous condenser unit to cost $35,000. Another central station in Connecticut is in the market for transformers and miscellaneous apparatus and is expected to place orders at an early date. A municipality in Wisconsin has contracted with a Middle West manufacturer for a turbine unit and condenser and with another maker for a cooling tower.

Industrial demand holds steady, while control equipment has been recording some good business and inquiries show further improvement. Motor sales are fair, with fractional-horsepower units securing sizable commitments. A manufacturer of washing machines in northern New York has purchased motor requirements to an amount of $40,000. The call for electrically heated melting pots for metal service, with control apparatus, has been exceptionally good, and wiring devices and affiliated merchandising items are decidedly active. A leading maker has taken an order for wiring apparatus from a New York interest to the sum of $135,000. Sales of electric lamps are reported as increasing and electric heating and cooking appliances are recording a good sales volume, as are electric refrigerators. Construction projects follow:

The Erie Railroad Company, New York, will build an engine terminal and coaling terminal at Meadville, Pa., to cost $250,000. The Moth Aircraft Corporation, New York, will build a plant at South Lowell, Mass., to cost $100,000. The American Sugar Refining Company, New York, plans an addition to its refining plant at New Orleans, La., to cost $250,000. The Frederick H. Levey Company, Brooklyn, will build an ink-manufacturing plant at Philadelphia, to cost $300,000. The Anaconda Copper Mining Company, New York, will make extensions and improvements in power plants at its Butte, Mont., properties. The American Salpha Company, care of Miles W. Beemer, Perth Amboy, N. J., will build a plant at Spotswood, N. J., to cost $750,000, for the manufacture of a material resembling paper. The U. S. Hammered Piston Ring Company, Inc., Irvington, N. J., will build a plant near Paterson, N. J., to cost $400,000. The American Dredging Company, Camden, N. J., has purchased property at Gloucester, N. J., and plans a ship repair yard to cost $300,000. The Crescent Insulated Wire & Cable Company, Trenton, N. J., will build an addition to cost $70,000.

The Atlantic Refining Company, Philadelphia, plans additions in its plant at Brunswick, Ga., to cost $300,000. The Hobson Flatware Company, Lansdale, Pa., plans a plant at Lambertville, N. J., to cost $75,000. The Philadelphia Air Terminal, Inc., Philadelphia, will install a floodlighting system and beacons at its proposed airport to cost $2,000,000. The East Coast Utilities Company, Salisbury, Md., plans a transmission line at West Dover, Del. The Standard Seamless Tube Company, Pittsburgh, contemplates an addition to its plant at Ambridge, Pa., to cost $400,000. The Division of Supplies, Department of Commerce, Washington, will receive bids until Dec. 27 for electric airway beacons for the Portland-Seattle section of the San Francisco-Seattle airway (Proposal 20310). The Bureau of Yards and Docks, Navy Department, Washington, will receive bids (no closing date announced) for an automatic refrigerating machine with accessories for the naval air station at Lakehurst, N. J. (Specification 5783.)

Power Equipment Selling in New England

Power equipment, including small motors, larger units and small turbo-generators, is attracting attention in the New England district. During the past week small motor sales were at a high level and sales of motors up to 300 hp. were noted. Orders were received for three 200-hp. motors for southern Massachusetts mills; another order comprised two 200-hp. motors, and a third rated at 100 hp. for a Maine industrial plant was recorded. Reports from industrial sections in Maine and southern Massachusetts indicate encouraging business in many textile plants. One manufacturer reports negotiations for small turbo-generators and sales of three such units recently, one of 300 kw. capacity and two of 200-kw. rating for Massachusetts locations. Switch and control apparatus sales are fair, wire orders are less and meter sales have fallen off somewhat, but the general tone of scheduled material sales is good.

Appliance sales are reported for 110 automatic washers in a recent campaign and 350 percolators were sold. One recent campaign reports sales of twelve hundred vacuum cleaners in one month.

A prominent engineering company has announced the closing of contracts for electrical equipment amounting to about $4,000,000. Construction projects are as follows:

The Wallace Barnes Company, Bristol, Conn., will make extensions at its wire spring plants to cost $500,000. The Wilson H. Lee Company, New Haven, Conn., plans a printing plant to cost $100,000. The Sikorsky Manufacturing Corporation, College Point, L. I., N. Y., will build an aircraft manufacturing plant at Stratford, Conn., to cost $400,000.

Street-Lighting Sales Active on Pacific Coast

Machinery manufacturers report a very slack week on the Pacific Coast with orders running chiefly to standard motors and distributing transformers. Power company business, too, is light, typical orders being two carloads of 6-in. 25-ft. poles for Watsonville; $1,000 worth of paper and leaded cable for Turlock and 4,000 16-in. steel pins for Santa Maria. Oil company business includes motors for the Standard fields near Bakersfield, service station material for the Associated at Ventura and a carload of 3-in. fiber conduit. San Francisco contractors are figuring on one carload of rubber-covered wire and two carloads of rigid iron conduit for the Methodist temple and hotel. Street-lighting business is the one bright spot of the week, orders including 50 General Electric units complete for the Peninsula district, 40 General Electric units for Hanford and a $13,572 award for 36 duplex lights in Stockton, while prospective business covers extensions to the present systems of Merced, Modesto and Oroville, 24 ornamental standards for Vallejo, 50 for Sacramento, a $14,000 extension for Richmond and a 102 duplex standard job for Stockton. Miscellaneous prospective business includes a $500,000 construction job at the Mare Island navy yard covering barracks and a storage battery building for the submarine service, conduit for Oakland's traffic signal system, a $1,250,000 school bond issue for Santa Ana, a packing plant for Orange, a $1,500,000 terminal warehouse system for Long Beach, a tile plant for Richmond and a 450-room hotel for Phoenix, Ariz.

Motor and apparatus movement in the Puget Sound district was very light, the largest order involving only $1,500 in motors for the Canyon Lumber Company of Everett. Industrial buying was light and scattered and this condition is expected to prevail until well after the first of the year. Plans for an $80,000 substation addition at the Puget Sound navy yard, Bremerton, was approved, the equipment including an 800-kw. motor-generator with additional cables and feeders. Specifications are being issued by the Puget Sound Power & Light Company for equipment totaling approximately $500,000 for the first unit of the steam plant at Renton, the apparatus involving between $50,000 and $60,000 in switchboards, $150,000 in transformers, $30,000 in turbines and pumps and miscellaneous apparatus. The Washington Electric Corporation, a subsidiary of the Puget Sound Power & Light Company, plans an $8,000,000 hydro-electric development on the Columbia River, to be known as the Rock Island development, near Wenatchee. Plans provide for a $2,500,000 dam, impounding 2,500 acre-feet of water and developing 60,000 hp. Bids ranging from $350,000 to $400,000 were opened by the city administration at Prince Rupert, B. C., for the construction of a municipally owned hydro-electric plant and bids opened for a telephone system in the same town ranged from $50,000 to $125,000. Renton, Wash., awarded a contract for a $9,500 street-lighting system. Construction projects are as follows:

The Lockheed Aircraft Corporation, Burbank, Calif., contemplates extensions in its plant to cost $100,000. Long Beach, Calif., plans a municipal automobile service, repair and garage building to cost $200,000. The California Sanitary Canning Company, Los Angeles, plans a factory on Long Beach Avenue, to cost $85,000. The Shell Oil Company, San Francisco, plans a storage and distributing plant to cost $175,000. Santa Maria, Sacramento, Porterville, Long Beach, Placerville and Los Angeles, Calif., plan ornamental lighting systems. The Northwest Steel Rolling Mill, Seattle, Wash., plans expansions in its plant to cost $85,000. Buhl, Idaho, is considering a municipal electric light and power plant to cost $100,000. The Boise-Payette Lumber Company, Emmett, Idaho, plans an addition to cost $150,000. Salt Lake City, Utah, plans an ornamental lighting system. The Utah-Idaho Sugar Company, Salt Lake City, Utah, plans a beet sugar mill at Lethbridge, Alberta, Canada, to cost $400,000. The Public Service Company of Colorado, Denver, Colo., contemplates extensions and improvements in the power plants at Boulder, Colo., during the coming year, to cost $1,000,000.

No Outstanding Orders in St. Louis District

The only contracts reported for the St. Louis district that are worthy of mention are a cable test set for one of the power companies to cost $8,000, a turbine unit for an Arkansas power company costing $35,000, and a miscellaneous lot of motors, switchboard and transformers to the western part of the district costing $12,000. Manufacturers are still doing good business in stock sizes of all kinds of apparatus. Jobbers report the movement of contractors' materials to be unusually good for the season, while the volume of central-station buying is small, probably owing to budgets being exhausted as the end of the year approaches. Construction projects are as follows:

The Gasconade River Power Company, Kansas City, Mo., plans a hydro-electric power project on the Gasconade River, Phelps County, to cost $300,000. Luther, Okla., plans an electric lighting system. Corsicana, Tex., plans a floodlighting system and beacons in its municipal airport, to cost $75,000. J. E. Morgan, San Juan, Tex., and associates plan a cold storage plant at Donna, Tex., to cost $80,000. The United Public Service Company, Chicago, will make extensions in the plant of the Texas Ice & Refrigerating Company, Fort Worth, Tex., recently acquired, to cost $75,000. The Central Power & Light Company, San Antonio, Tex., plans an expansion and improvement program for 1929, to cost $5,000,000.

Middle West Reports Good Business

The volume of business is holding up well in the Middle West and although some slackening off of industrial activity is noticeable, for the most part the recession is made up in other lines. The continuance of building activity in Chicago and suburban districts is contributing materially to the general prosperity. The steel and automotive industry are prosperous and car loadings are favorable. Reports from the agricultural districts indicate a satisfactory condition. The utility companies are engaged with a large amount of maintenance and construction work, while budgets for the coming year are being completed. There has been a good demand for poles, pole line hardware, transformers, insulators, wire and cable. Jobbers' sales are generally satisfactory. Construction projects are as follows:

The Allis-Chalmers Manufacturing Company, West Allis, Wis., will make extensions in the tractor manufacturing division, to cost $2,000,000. The Federal Motor Truck Company, Detroit, will soon take bids for a plant addition to cost $230,000. The Foster Airways, Inc., Detroit, plans a floodlighting system and beacons in connection with extensions in its municipal airport to cost $150,000. The Timken-Detroit Axle Company, Detroit, will build an addition to cost $75,000. The Pere Marquette Railroad Company, Detroit, plans a storage and distributing plant at Grand Rapids, Mich., to cost $100,000. The Michigan Bell Telephone Company, Lansing, Mich., plans extensions in underground conduits and overhead lines to cost $100,000. The Illinois Electric Company, Chicago, will soon take bids for an equipment storage and distributing plant to cost $400,000. Morton Grove, Ill., plans an ornamental lighting system. The Caterpillar Tractor Company, San Leandro, Calif., plans expansions in the local plant and in the branch factory at Peoria, Ill., to cost $1,000,000. Fort Wayne, Ind., plans an addition to its municipal electric light and power plant to cost $300,000. The Northern Ohio Power & Light Company, Akron, Ohio, plans expansions at the Gorge power plant at Kent, Ohio, to cost $330,000. The G. & G. Manufacturing Company, Cincinnati, Ohio, plans an addition to its stamp and die manufacturing plant to cost $60,000. The American Steel & Wire Company, Cleveland, plans an addition to its rod mill, to cost $200,000. The National Acme Company, Cleveland, plans an addition to its machine tool plant to cost $75,000. The International Derrick & Equipment Company, Delaware, Ohio, plans an addition to its machinery plant to cost $70,000. The Gardner & Harvey Company, Middletown, Ohio, plans an addition to its paperboard mill to cost $160,000. The Toledo Edison Company, Toledo, Ohio, plans an expansion program to cost $2,000,000, including extensions in power plants and transmission lines. The Jerpe Cold Storage Company, Omaha, Neb., will soon take bids for an addition to its cold storage and refrigerating plant to cost $50,000. Coggon, Iowa, plans a municipal power plant.

Activities of the Trade

Square D Company Announces Staff Changes

Following a transfer of capital stock of the Square D Company, Detroit, manufacturer of electrical equipment, T. J. Kauffman has assumed the title and duties of president, in addition to those of general manager and operating head of the business, which he has held for the past seventeen years. Until he assumed the office of president Mr. Kauffman also acted as treasurer of the Square D Company. This office has now been taken over by W. S. Worcester, secretary.

Except for Mr. Horton's retirement, the active management of the Square D Company remains unchanged under the reorganization. A. A. Schueler, who has been with the company for fourteen years, will remain in the position of general sales manager, which he has occupied for the past seven years. C. L. Hull, for eight years a member of the organization, will remain as assistant sales manager. L. W. Mercer, whose connection with Square D dates from 1917, has been appointed assistant general manager.

A substantial block of Square D capital stock, representing the interests of B. D. Horton, retiring president, and A. MacLachlan, has been purchased by Keane, Higbie & Company, Detroit investment bankers. On completion of recapitalization these units were listed on the Detroit Stock Exchange and have been offered to the investing public. The company reports that it has made a highly gratifying showing during 1928 and the current year will close with a substantial increase in both sales volume and earnings.

General Electric Transfers Its Installment Business

Details of the policy adopted by the General Electric Company with regard to installment sales were announced last week.

Since 1921 the company has been financing time installment sales of electrical products in which General Electric apparatus has formed a part and at the close of 1926 advances of $18,073,000 had been made to its subsidiary financing companies to enable them to carry on this business. At a later date a maximum of $20,215,000 was advanced.

Over this period of operation more than 800,000 contracts, amounting to upward of $114,000,000, were financed. In addition to the direct sales that were made and the profit from the business there were important collateral advantages in increasing the use of electrical devices in homes and workshops.

Recognizing that installment financing is a specialized field of banking, requiring special treatment, preferably by an organization that is skilled and experienced in this line, and as the scope of operations should become greater and the volume should increase in the coming years, it was decided to turn the business over to an organization specializing in this form of banking. To this end the company on June 30, 1928, sold to the Industrial Acceptance Corporation the entire stock of the General Contract Purchase Corporation, New York, and its affiliated companies.

THE LINCOLN METER COMPANY, INC., Springfield, Ill., has been organized to manufacture Lincoln maximum demand meters and other Lincoln products. L. Dana Johnson has been appointed sales manager of the company.

THE INTERNATIONAL COMBUSTION ENGINEERING CORPORATION, 200 Madison Avenue, New York City, has closed a contract with the Lukens Steel Company of Coatesville, Pa., for the building of a low temperature coal carbonization plant at Coatesville. This will be the first low temperature carbonization plant identified with the steel industry and the second installation in America. The new plant will be owned and operated by the International Coal Carbonization Company, a subsidiary of the International Combustion Engineering Corporation, which will sell the gas to the Lukens Steel Company, under a long-term contract.

THE WAGNER ELECTRIC CORPORATION, St. Louis, announces a new furnace fan designed for use in warm air furnaces to raise the efficiency of warm air furnaces and also give absolute control over the flow of warm air to every room in the house. The fan is obtainable in three sizes, 12 in. for small houses or flats, 16 in. for larger houses and 18 in. for very large houses.

THE NATIONAL LAMP WORKS of the General Electric Company, Nela Park, Cleveland, has appointed T. D. Scarff as assistant general manager of its Chicago office.

THE HART MANUFACTURING COMPANY, Hartford, Conn., manufacturer of electrical equipment, will take bids at once for an addition to its plant on Bartholomew Avenue to be 60 ft. x 120 ft.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, manufacturer of electric controlling devices, announces the removal of its Atlanta office to larger quarters at 150 Peters Street, S. W., Atlanta, Ga., with A. C. Gibson as manager.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY recently received orders for three 2,000-kva. transformers which will be installed in the Montaup Electric Company's plant; in addition, this company records an order for four 2,000-kva. transformers for the Gulf States Utilities Company.

Frigidaire Price Reductions

PRICE reductions on its line of household electric refrigerators ranging up to $90 have been announced by Frigidaire Corporation, Dayton, Ohio, effective Dec. 10. The general cut will average close to 10 per cent of the list prices, E. G. Biechler, president and general manager, said. A price reduction of from $15 to $40 in the organization's complete line of electrically refrigerated ice cream cabinets was also announced. It is anticipated that the new price range will stimulate business to such a degree that the year 1929 will exceed even the business of 1928, when a record peak was reached in sales.

A similar reduction up to $90 on household refrigerators was made by the Frigidaire Corporation in August, 1926, in anticipation of mass production of the products, which was inaugurated a short time later. The price reductions follow on the heels of the decision of the corporation to make the largest personnel increase in the history of the business during the coming year. Plans have just been perfected at Dayton for a tremendous increase of personnel both in the home offices and plants and in the field.

The rapid headway being made with automatic water coolers, a modification of the conventional electric refrigerator, designed to meet a need in offices, factories and public buildings as well as residences, has also resulted in the necessity for increasing the man power of the corporation and hundreds of more men will be employed next year in this field alone.

THE NATIONAL FLUE CLEANER COMPANY, INC., Groveville, N. J., manufacturer of soot blowers for fire tube boilers, announces the appointment of the following agents: McGee Sales Agency, 75 Fremont Street, San Francisco; Flickinger, Meyers & Rudolph, 129 West Second Street, Los Angeles, and Manufacturers' Sales-Service, P. O. Box 655, Salt Lake City, Utah. W. A. Ramsay, Ltd., Honolulu, was appointed as its representative for Hawaii.

THE PHILADELPHIA STORAGE BATTERY COMPANY, Philadelphia, has purchased adjoining property totaling 100,000 sq.ft., with a large factory, and will use it for expansion.

BRITAIN USING MORE GAS-FILLED LAMPS.—It is pointed out in a recent report of the Electricity Commissioners of the United Kingdom that in the period 1921-22 to 1925-26 the average revenue from current for lighting purposes has decreased over 33 per cent,

and that the price of bulbs has never been so low as at present. Vacuum lamps are 38 per cent cheaper and gas-filled lamps 60 per cent cheaper than in 1918, resulting in the much wider adoption of the gas-filled lamp. A number of gas-filled lamps, ranging up to 4 kw., are now in use, in navigation, in lightships and lighthouses combining the features of full brightness when visible and sudden absolute darkness.

THE GRAYBAR ELECTRIC COMPANY announces that larger and more spacious quarters for the Nashville, Tenn., branch will be opened at 315 Eighth Avenue, South. The plant for many years has been located at 3 Cummins Station.

THE TIMKEN ROLLER BEARING COMPANY, Canton, Ohio, has established two new offices, one in Los Angeles, in charge of Roy Cross, with offices at 1361 South Figueroa Street, and one in Seattle, Wash., in charge of Marshall Cooledge, with offices at 321 South Pine Street.

THE BOTFIELD REFRACTORIES COMPANY, Swanson and Clymer Streets, Philadelphia, manufacturer of "Adamant" fire brick cement, announces that the McCarthy-Jones & Allen Company, Inc., 111 First Avenue South, Nashville, Tenn., has been made a distributor for the company.

THE INDIANA LAMP CORPORATION, Connersville, Ind., manufacturer of electric lamps for automobile headlight service, etc., is considering a new addition to its plant at West Twentieth Street and Western Avenue.

THE STANDARD UNDERGROUND CABLE COMPANY, Pittsburgh, a division of the General Cable Corporation, announces that Max Rubenstein has been transferred from its Philadelphia sales office to the company's Pittsburgh office, where he will devote his time to the promoting of sales of cable accessories.

THE GENERAL ELECTRIC COMPANY is planning the construction of a factory branch and distributing plant at Pershing Road and Ashland Avenue, Chicago, with service and operating departments. Graham, Anderson, Probst & White, Chicago, are the architects.

THE OHIO BRASS COMPANY, Mansfield, Ohio, announces the appointment of Harvey H. Hoxie as district sales manager of the power utilities division for the New England territory, with offices in the Little Building, 80 Boylston Street, Boston.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received the first order from the Pennsylvania Power & Light Company for its new multipart pin type insulators with metallic glaze in the tie and line wire grooves.

THE WAGNER ELECTRIC CORPORATION, St. Louis, announces that F. T. Coup has been appointed branch manager of the Milwaukee office of the company. Mr. Coup has been with the company since 1912 and his transfer to the Milwaukee office ended seven years of managerial duty at Cincinnati. The company also announces the appointment of Paul F. Forsyth as branch manager of the Cincinnati office. Mr. Forsyth served as salesman in the Chicago, Detroit and Cincinnati districts since 1915. H. N. Felton, who since 1927 has been branch manager of the Milwaukee office, has been appointed branch manager of the company's New York office.

New Equipment Available

Copper U Strain Clevis for Strain Insulators

A new copper "U" strain clevis for use with strain insulators has been brought out by the Line Material Company, South Milwaukee, Wis. Variations in the manufacture of insulators have made it desirable to bring out this new line of clevises. The "U" being of copper conforms to the shape of the insulator and in this way distributes the pressure evenly over the entire surface, eliminating the concentration of the stresses at irregular high points on the surface. The available strength of the insulator, it is claimed, is very much increased when this clevis is used. When installing, the copper "U" has one leg bent at a slight angle which is threaded through the insulator. The upset heads of the "U" when inserted into the notches on the forged steel top have sufficient tension to prevent the clevis coming apart in handling or during installation.

Tubular Bulb Lamp

The National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio, is manufacturing a new 25-watt tubular bulb lamp which is about the size of the average fountain pen. The new lamp is designed for showcase and other lighting service where small size bulb is desired. It is expected that it will prove popular for the lighting of interior signs, coves, pictures, decorative ornaments, wall brackets, and other fixtures. The intermediate screw base permits the use of a smaller socket than does the medium screw base of other tubular lamps. The new lamp has a T-6½ bulb, approximately ¾ in. in diameter. The over-all length is 5½ in. and is available in 110, 115 and 120 volts.

Polyphase Ammeters for A.C. Circuit

A new polyphase ammeter under the classification of type HEA-3, for three-phase alternating-current circuits, has been announced by the Roller-Smith Company. With this ammeter it is possible to take readings simultaneously in each of the phases of a three-phase circuit. It is also possible for the observer to see at a glance what the current is in each of the three phases and thus to determine instantly whether the phases are properly balanced. A special feature is a long 7⅛-in. scale and the relatively small space occupied by the instrument as compared with that which would be occupied by three individual instruments.

Portable Current Transformer

A current transformer of a new type allowing for current measurements ranging from 0.2 to 200 amp. when used in combination with a 1-amp. instrument has been placed on the market by the Weston Electrical Instrument Corporation, Newark, N. J. The new model is number 539 and is designed especially for industrial and educational purposes. Its special advantage is that it permits measurements below 1 amp.

This transformer is designed primarily as a companion instrument to previous model 528. It has four self-contained primary ranges of 2, 5, 10 and 20 amp., which are changed by means of a range-changing switch on the top of the transformer.

SOUND-CONTROLLED TRAFFIC SIGNAL FOR OUTLYING INTERSECTIONS.—Sound and light function in a new traffic control system in which traffic controls itself. Vexatious halts where there is little cross traffic are eliminated. Pedestrians may secure the right of way by pushing a button. The automobile horn is a vital factor in the plan devised by Charles Adler, Jr., of Baltimore, which is being introduced by the General Electric Company under the name of the General Electric Novalux traffic-operated controller. In the new device the sound of the horn starts an electric sequence. A sensitive microphone inside the sound collector on a pole near the curb picks up the sound, converts it into an electrical impulse, which operates a mechanism to change the lights. After a predetermined interval the lights change again for the normal course of traffic. A second motorist approaching on a side street just after the lights have changed must await the completion of the timing cycle. Cross traffic cannot hold up main traffic indefinitely. Even if cross traffic is heavy at times, main traffic is still assured the right of way at stated intervals and recaptures the continuous right of way as soon as the rush of cross traffic ceases.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 27, 1928)

1,692,806. ELECTRIC OUTLET-BOX SUPPORT; L. Barnett, Brooklyn, N. Y. App. filed May 7, 1927.

1,692,849. METHOD OF DETERMINING THE NATURE OF SUBSOIL; M. Mason, Chicago, Ill. App. filed May 3, 1926.

1,692,867. LINK MECHANISM FOR CIRCUIT BREAKERS; D. Rönnberg and A. Rooth, Ludvika, Sweden. App. filed June 4, 1926.

1,692,869. ELECTRIC WATER HEATER; C. J. Scanlan, Bloomington, Ill. App. filed Oct. 23, 1925.

1,692,874. APPARATUS FOR PASTEURIZING MILK; J. O. Templeton, Detroit, Mich. App. filed Jan. 6, 1926.

1,692,875. PROTECTIVE HOUSING FOR ELECTRICAL DEVICES; P. Vannini, Zug, Switzerland. App. filed Feb. 26, 1927.

1,692,893. TROLLEY CONSTRUCTION; G. C. Gutzat, Jersey City, N. J. App. filed Jan. 31, 1927.

1,692,895. RAIL BOND AND METHOD OF MAKING THE SAME; W. F. Hart, Pittsburgh, Pa. App. filed April 3, 1926.

1,692,961. ALTERNATING-CURRENT RELAY; E. O. Thompson, Tompkinsville, N. Y. App. filed Dec. 29, 1921.

1,692,962. MOTOR CONTROLLER; R. G. Thompson, Rochester, N. Y. App. filed Nov. 2, 1925.

1,693,009. RHEOSTAT; C. E. Warner, Berwyn, Ill. App. filed Jan. 26, 1925.

1,693,027. AUTOMATIC SWITCH; J. Erickson, Chicago, Ill. App. filed April 29, 1921.

1,693,126. ADJUSTABLE LOCKING BEARING; T. Van Ryan and A. Alsaker, Chicago, Ill. App. filed Sept. 27, 1926.

1,693,133. ELECTRIC HEATER; P. R. G. Biedermann, Los Angeles, Calif. App. filed July 29, 1927.

1,693,135. ELECTROMAGNET; A. D. Cardwell, Rockville Center, N. Y. App. filed Feb. 17, 1927.

1,693,145. ADJUSTABLE SOCKET FOR LUMINESCENT-TUBE SIGNS; W. F. Hendry, Ossining, N. Y. App. filed Oct. 27, 1926.

1,693,178. REACTANCE DEVICE; S. M. Lucas, Pittsburgh, Pa. App. filed April 2, 1927.

1,693,182. HEATING DEVICE; R. Rochester, Jr., Chicago, Ill. App. filed June 24, 1926.

1,693,256. AUTOMATIC CURRENT-CUT-OUT ELECTRIC FLATIRON; J. J. Shea, San Diego, Calif. App. filed Jan. 29, 1926.

1,693,271. ELECTRICAL HEATING AND FORMING MEANS; A. G. Dannell, New York, N. Y. App. filed May 11, 1927.

1,693,293. CONTROL SYSTEM; W. N. Gittings, Springfield, Pa. App. filed Dec. 23, 1927.

1,693,294. ELECTRIC MOTOR; C. A. Guterres, Santa Monica, Calif. App. filed Dec. 29, 1926.

1,693,296. SPEED-CONTROL AND FREQUENCY-CONVERTER SET; J. I. Hull, Schenectady, N. Y. App. filed Dec. 6, 1924.

1,693,303. ELECTRIC TERMINAL EQUIPMENT; F. Mackintosh, Schenectady, N. Y. App. filed Dec. 13, 1927.

1,693,306 and 1,693,307. REGULATING SYSTEM; G. R. McDonald, Schenectady, N. Y. Apps. filed Feb. 5, 1926.

1,693,309. SIGNALING DEVICE; A. L. Mettler, San Pedro, Calif. App. filed April 28, 1924.

1,693,313. ELECTRICAL CONTROL DEVICE; E. J. Murphy, Schenectady, N. Y. App. filed July 9, 1924.

1,693,314. MEANS FOR REPRODUCING POSITION; E. J. Murphy, Schenectady, N. Y. App. filed July 9, 1924.

1,693,316. VACUUM-TUBE CIRCUITS; D. C. Prince, Schenectady, N. Y. App. filed May 4, 1923.

1,693,319. TENSION INDICATOR FOR BRUSH HOLDERS; H. O. Simmons, Schenectady, N. Y. App. filed Dec. 1, 1926.

1,693,322. BRUSH HOLDER; M. J. Stanton, Pittsfield, Mass. App. filed March 2, 1927.

1,693,325. SELECTIVE-CIRCUIT-CONTROLLING SYSTEM; O. C. Traver, Schenectady, N. Y. App. filed Nov. 17, 1925.

1,693,328. AUTOMATIC RECLOSING-CIRCUIT-BREAKER SYSTEM; A. E. Anderson, Scotia, N. Y. App. filed June 21, 1926.

1,693,359. CONNECTION FOR ELECTRICAL CONDUCTORS; A. Wichert, Mannheim-Neuostheim, Germany. App. filed Jan. 27, 1927.

1,693,362. THERMAL PROTECTIVE SYSTEM; H. Beiersdorf, Berlin-Grunewald, Germany. App. filed Oct. 29, 1925.

1,693,364. ELECTRIC HEATER FOR PERCOLATORS AND THE LIKE; A. Bersted and M. Bersted, Chicago, Ill. App. filed April 23, 1927.

1,693,365. METHOD OF FORMING HIGH-TENSION CABLE JOINTS OR SPLICES FOR UNDERGROUND SYSTEMS; W. E. Boyle and H. R. Searing, New York, N. Y. App. filed Dec. 6, 1924.

1,693,379. THERMAL RELAY; H. S. Gano, Pittsburgh, Pa. App. filed June 23, 1926.

1,693,380 and 1,693,381. INSULATOR; G. I. Gilchrest, Wilkinsburg, Pa. Apps. filed Oct. 18, 1919 and Jan. 20, 1920.

1,693,382. SWITCH MOUNTING; D. D. Gordon, Chicago, Ill. App. filed Jan. 31, 1925.

1,693,385. BATTERY; F. W. Hochstetter, Pittsburgh, and W. Broad, Mars, Pa. App. filed Jan. 21, 1926.

1,693,402. RELAY SYSTEM; A. J. A. Peterson, Wilkinsburg, Pa. App. filed March 27, 1925.

1,693,404. THERMAL CUT-OUT; M. J. Sandin, Wilkinsburgh, Pa. App. filed Jan. 23, 1923.

1,693,421. INCASED HEATING UNIT; J. C. Woodson, Mansfield, Ohio. App. filed March 31, 1927.

1,693,426. TRANSMISSION DEVICE; C. T. Allcutt, Pittsburgh, Pa. App. filed Dec. 20, 1923.

1,693,443. LIGHTING FIXTURE AND THE LIKE; D. Holt, Chicago, Ill. App. filed May 23, 1927.

1,693,453. INCANDESCENT LAMP; F. C. McElroy, Columbus, Ohio. App. filed Nov. 4, 1925.

1,693,462. WAVING IRON FOR HAIR; J. P. Polnaszek, Minneapolis, Minn. App. filed May 28, 1927.

1,693,491. VIBRATOR FOR ALTERNATING-CURRENT RECTIFIERS; C. E. Ogden, Cincinnati, Ohio. App. filed Oct. 2, 1922.

1,693,522. ELECTRIC STEAM TABLE; R. E. Medearis, Nashville, Tenn. App. filed Nov. 3, 1927.

1,693,574. SYSTEM OF DISTRIBUTION; A. W. Copley, San Francisco, Calif. App. filed Nov. 7, 1917.

1,693,587. INDUCTION-MOTOR-CONTROL SYSTEM; H. V. Nye, West Allis, Wis. App. filed July 30, 1920.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Wellington, New Zealand (No. 34,878), for electro dental apparatus.

An agency is desired in Medan, Sumatra (No. 34,835), for flashlights.

Purchase is desired in Basel, Switzerland (No. 34,836), of electric furnaces for tempering or hardening steel.

An agency is desired in The Hague, Netherlands (No. 34,812), for portable electric grinders.

Purchase is desired in Prague, Czechoslovakia (No. 34,833), of household electric appliances.

Purchase and agency are desired in Hamburg, Germany (No. 34,832), for household electric appliances, dishwashers and washing machines and household electric refrigerators.

An agency is desired in Calgary, Canada (No. 34,839), for household electric appliances, especially washing machines.

An agency is desired in Constantinople, Turkey (No. 34,854), for electric motors.

Purchase and agency are desired in The Hague, Netherlands (No. 34,802), for domestic absorption type refrigerators.

An agency is desired in Rome, Italy (No. 34,838), for all kinds of spark plugs.

Purchase is desired in Calcutta, India (No. 34,834), of 100 pole mounted oil switches.

Purchase and agency are desired in Kobe, Japan (No. 34,830), for enameled copper wire.

Purchase is desired in Berlin, Germany (No. 34,879), of X-ray and therapeutic apparatus.

New Trade Literature

INDUSTRIAL LIGHTING AND CONNECTOR. — The Cooper-Hewitt Electric Company, Hoboken, N. J., is distributing catalog No. 500 entitled "Cooper-Hewitt Work-Light for Industrial Lighting," in which it gives an outline of adapting light for various purposes and instructions regarding the installation of the system. It also contains illustrations showing various installations of the system. The company also has issued bulletin No. 600 describing and illustrating the Cooper-Hewitt mercury "Kon-nector" for use in sign flashers, relays, time clocks, motor controls, door controls, heat-control devices, thermostatic switches and for locations subject to fire hazard.

BELT DRIVES.—Bulletin No. 1228-H issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes the Allis-Chalmers "Texrope" drives. Illustrations showing various applications of the drives are included.

LINE STARTERS AND MOTORS. — Leaflet L-20,394 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates its class 11-200 line starters for squirrel-cage and wound-rotor induction motors. The company also is distributing leaflet L-20,386, covering its type CS line start squirrel-cage motors equipped with sealed sleeve bearings, and leaflet L-20,333-A, describing its type HR low-speed, engine type synchronous motors.

OIL CIRCUIT BREAKERS.—A publication issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates its type O-30 electrically operated oil circuit breakers for indoor and outdoor service.

OIL HEATING.—The Super Oil Heater Company, Pawtucket, R. I., is distributing a booklet entitled "New Profits on Present Capital." The booklet is well illustrated with graphs showing various factors of interest relating to the power consumption of appliances, the proportion of wired homes and other factors dealing with the extension of the power market. It also contains data on the relative use of power by the oil burner in comparison with other appliances indicating the kilowatt-hour consumption of each.

ARC-WELDING SETS, MOTOR DRIVE, etc.—The General Electric Company, Schenectady, N. Y., has issued a series of bulletins. Bulletin GEA-569B describes its constant-potential arc-welding sets, GEA-881A covers the General Electric gas-engine-driven arc welder, GEA-1072 describes its electric motor drive for cotton pickers, GEA-1073 covers its electric motor drive for cotton roving machinery, GEA-1066 covers its centrifugal air compressors for sewage disposal systems and GEA-1062 describes its line contacts for outdoor group-operated disconnecting switches.

ELECTRIC HEATING EQUIPMENT. — Lee P. Hynes, 30 Church Street, New York City, is distributing a catalog covering the Hynes electric heat systems using fan circulation of warm air with automatic control for heating power houses, substations, depots, storage rooms, garages, pump houses and all types of industrial buildings, also for hot air drying and other industrial processes requiring heated air. He also has issued a catalog describing the Hynes electric heaters designed for office buildings, residences, power houses, steamships and for general industrial service.

COMPRESSORS. — The Worthington Pump & Machinery Corporation, 2 Park Avenue, New York City, is distributing bulletin No. L-620-B1 covering its vertical feather-valve compressors. The various parts of the compressors are illustrated and questions and answers are included.

HAND TACHOMETERS.—The O. Zernickow Company, 15 Park Row, New York City, has issued a catalog describing and illustrating the O-Z improved hand tachometers. A sectional view of the tachometer and instructions for its use are included and attention also is called to the O-Z stationary tachometers.

JUNCTION AND JOINT BOXES.—The Standard Underground Cable Company, Pittsburgh, division of the General Cable Corporation, has issued bulletin No. 720-2 describing its junction and joint boxes. The bulletin contains illustrations and complete information, including drawings, dimension tables and other engineering information, also a few installation views.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

Radio Apparatus—How Much Is Made?

Increase of Socket-Power Devices

IN 1927 the value of radio apparatus, including tubes, manufactured in the United States was $191,848,665. In 1921 the corresponding amount was $10,647,617. These are factory values, according to the census of manufactures. The increase is an eighteenfold one in half a dozen years. Curiously, vacuum tubes constituted about a tenth of the total at the beginning and again at the end of the period, though rising to nearly a fifth in 1923.

Short as the period has been, notable shifts are revealed by the biennial statistics. In 1921 the industry was so new that only a lump-sum total was given. In 1923 it was first broken into classes: Vacuum-tube receiving sets, $13,326,116; crystal sets, $669,906; loud speakers, $5,608,330; head sets, $5,345,380; transformers and rheostats, $5,307,013; miscellaneous devices, $12,999,623; transmitting sets, $919,930; tubes, $9,824,172.

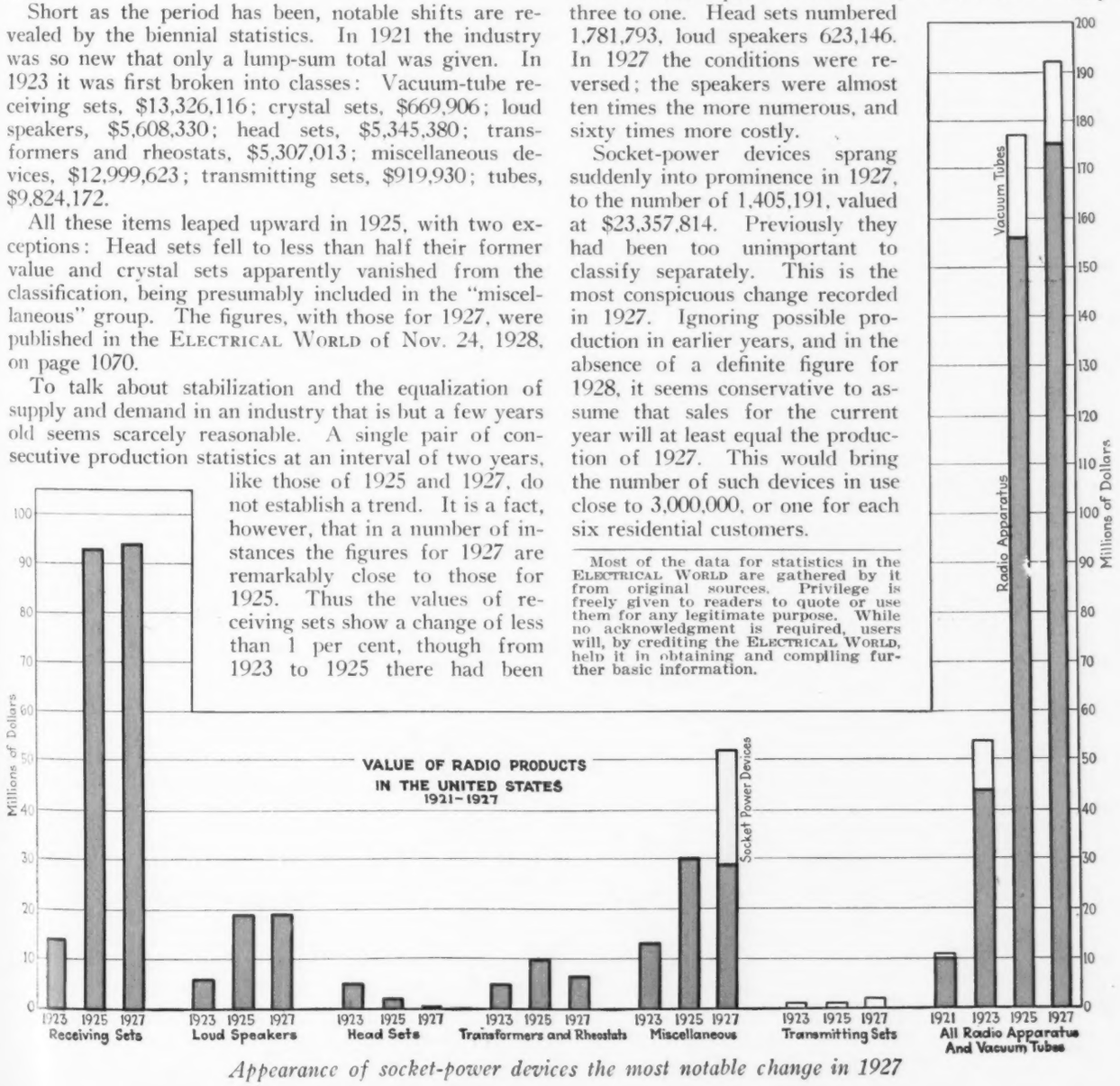
All these items leaped upward in 1925, with two exceptions: Head sets fell to less than half their former value and crystal sets apparently vanished from the classification, being presumably included in the "miscellaneous" group. The figures, with those for 1927, were published in the ELECTRICAL WORLD of Nov. 24, 1928, on page 1070.

To talk about stabilization and the equalization of supply and demand in an industry that is but a few years old seems scarcely reasonable. A single pair of consecutive production statistics at an interval of two years, like those of 1925 and 1927, do not establish a trend. It is a fact, however, that in a number of instances the figures for 1927 are remarkably close to those for 1925. Thus the values of receiving sets show a change of less than 1 per cent, though from 1923 to 1925 there had been a rise of 600 per cent; that is, a sevenfold increase.

The same constancy appears in loud speakers; again the values for 1925 and 1927 are almost equal; in the preceeding two-year period they had more than trebled. Head sets, constituting an eighth of the total in 1923, had gone quite out of fashion by 1927. In fact, in the earlier year loud speakers and head sets shared the field equally in terms of money; numerically, the head sets were by far the more important of the two, in the ratio of nearly three to one. Head sets numbered 1,781,793, loud speakers 623,146. In 1927 the conditions were reversed; the speakers were almost ten times the more numerous, and sixty times more costly.

Socket-power devices sprang suddenly into prominence in 1927, to the number of 1,405,191, valued at $23,357,814. Previously they had been too unimportant to classify separately. This is the most conspicuous change recorded in 1927. Ignoring possible production in earlier years, and in the absence of a definite figure for 1928, it seems conservative to assume that sales for the current year will at least equal the production of 1927. This would bring the number of such devices in use close to 3,000,000, or one for each six residential customers.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.



Appearance of socket-power devices the most notable change in 1927

North Central Production 28.2 per Cent Over Last Year

THE rate of general manufacturing production in the North Central States during the month of November continued on the same high plane as reported for September and October. Consumption of electrical energy by over 1,200 of these plants indicates that the rate of manufacturing operations during November, after adjustments are made for the number of working days, was 0.3 per cent under October, but was 28.2 per cent over November last year. This percentage rate of twelve-month increase has been maintained during the past three months. The average rate of operations for the first eleven months of the current year was 14.2 per cent above that for the same period last year.

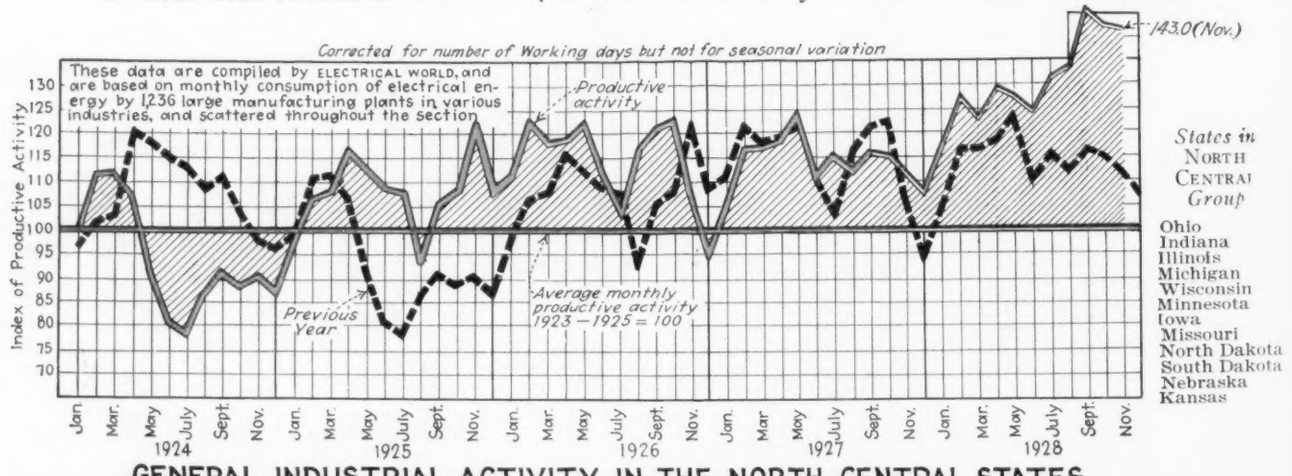
The basic reports for November, however, indicate that for the first time in some months several of the industrial groups reported a material drop in rate of operations. This decrease, however, was counteracted by increased operations in several of the other industrial groups. The automobile industry, including the manufacture of repair and replacement parts, reported a drop in operations during November of 12.5 per cent, but these plants were still operating on a plane 22.5 per cent above November last year.

Indexes of Productive Activity in the North Central States

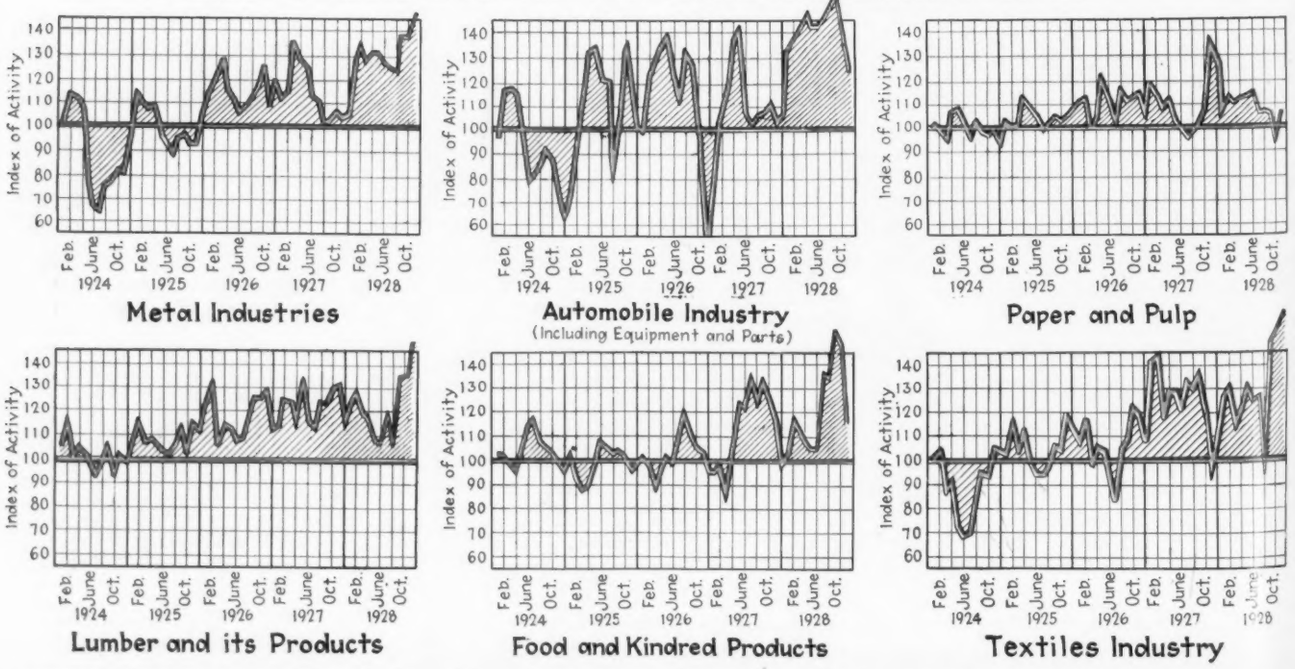
All Figures Adjusted for Number of Working Days

	November, 1928	October, 1928	November, 1927	Average for First Eleven Months, 1928	Average for First Eleven Months, 1927
All industries	143.0	143.5	111.4	131.6	115.0
Chemical and allied products	219.2	191.8	113.5	152.3	100.6
Textiles	191.7	166.4	95.5	134.8	127.5
Lumber and its products	148.8	132.3	130.5	121.7	122.3
Paper and pulp	104.8	93.8	134.7	107.5	108.5
Automobile, including the manufacture of parts	123.4	141.0	100.8	143.8	110.5
Metals group	147.2	138.4	103.4	132.5	114.1
Rolling mills and steel plants	148.0	145.5	110.3	134.4	118.5
Metal-working plants	146.4	130.4	96.6	130.4	.....
Food and kindred products	114.0	153.4	112.8	122.6	.....
Leather and its products	98.4	100.4	108.2	105.7	.....
Rubber and its products	151.8	152.7	153.2	142.1	.....
Stone, clay and glass	141.5	142.0	98.7	117.6	.....

ELECTRICAL WORLD *Barometer of Industrial Activity in the North Central States*



GENERAL INDUSTRIAL ACTIVITY IN THE NORTH CENTRAL STATES



PRODUCTIVE ACTIVITY IN PRIMARY INDUSTRIES OF NORTH CENTRAL STATES